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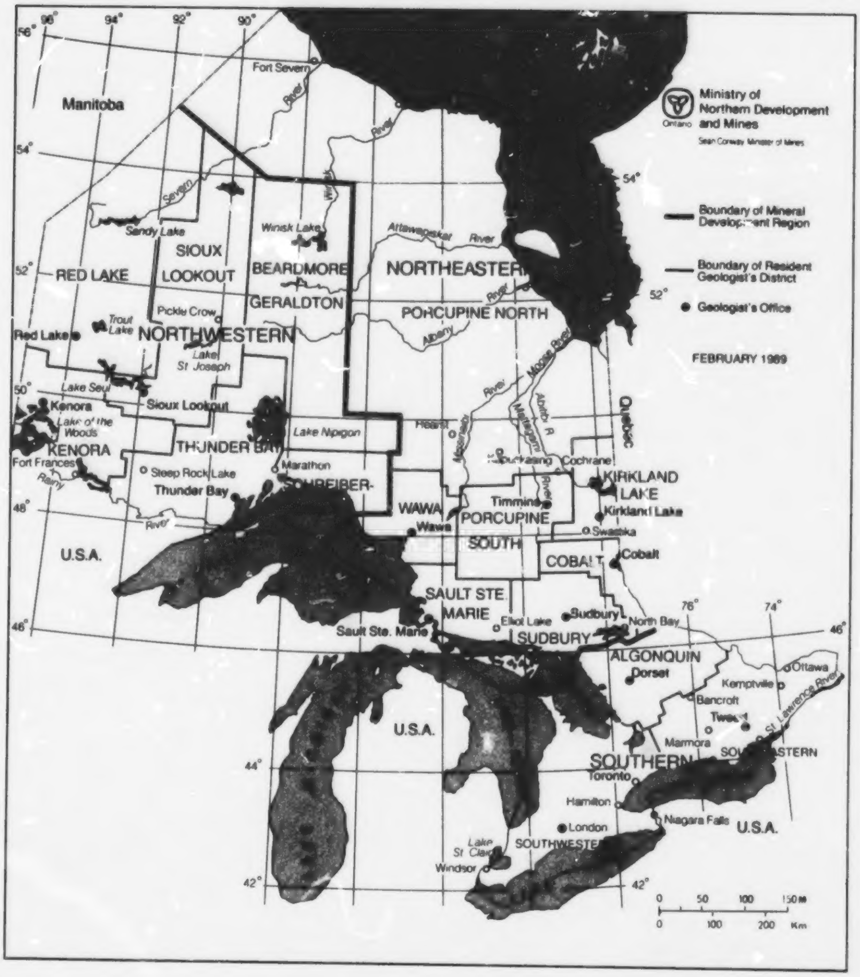
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Ontario
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RED LAKE
SIOUX LOOKOUT
BEARDMORE
GERALDTON
NORTHWESTERN
NORTHEASTERN
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KENORA
THUNDER BAY
SCHREIBER-
WAWA
PORCUPINE SOUTH
KIRKLAND LAKE
COBALT
SAULT STE MARIE
SUDBURY
ALGONQUIN
SOUTHERN
SOUTHEASTERN
SOUTHWESTERN
U.S.A.
Fort Severn
Sandy Lake
Winisk Lake
Pickle Crow
Red Lake
Trout Lake
Lake St Joseph
Lake Seul
Kenora
Lake of the Woods
Sioux Lookout
Lake Nipigon
Fort Frances
Steep Rock Lake
Thunder Bay
Marathon
Hearst
Kapuskasing
Cochrane
Timmins
Kirkland Lake
Swastika
Cobalt
Wawa
Sault Ste. Marie
Elliot Lake
Sudbury
North Bay
Dorset
Ottawa
Kemptville
Bancroft
Tweed
Marmora
Toronto
Hamilton
Niagara Falls
London
Lake St Clair
Windsor
Severn River
Winisk River
Attawapiskat River
Albany River
Moose River
Abitibi R
Mattagami River
Missinaibi River
Rainy River
St Lawrence River
56°
54°
52°
50°
48°
46°
44°
42°
96°
94°
92°
90°
76°
74°
0 50 100 150 mi
0 100 200 Km

RESIDENT GEOLOGISTS' OFFICES

Kenora	Box 5200, 808 Robertson St., Kenora P9N 3X9	(807) 468-3658
Red Lake	Box 324, Ont. Govt. Bldg., Red Lake P0V 2M0	(807) 727-3272
Sioux Lookout	Box 3000, Court House Bldg., Sioux Lookout P0V 2T0	(807) 737-2039
Thunder Bay	Box 5000, 435 James St. S., Thunder Bay P7C 5G6	(807) 475-1331
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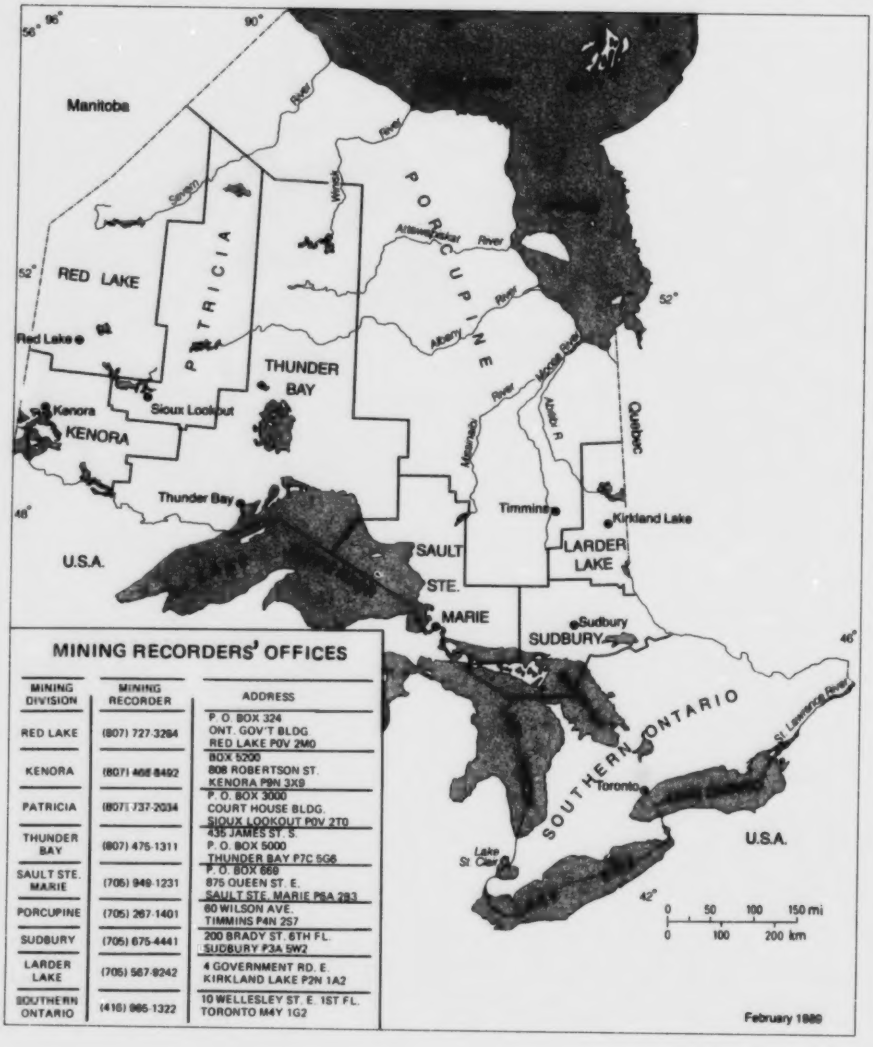
Schreiber-Hemlo	Box 5000, 435 James St. S., Thunder Bay P7C 5G6	(807) 475-1331
Porcupine	60 Wilson Ave., Timmins P4N 2S7	(705) 267-1401
Kirkland Lake	4 Government Rd. E., Kirkland Lake P2N 1A2	(705) 567-5242
Sault Ste. Marie	Box 130, 875 Queen St. E., Sault Ste. Marie P6A 5L5	(705) 949-1231
Wawa	Box 530, Helen Mine Rd., Wawa P0S 1K0	(705) 856-4883
Cobalt	Box 230, Presley St., Cobalt P08 1C0	(705) 679-8558
Algonquin	Box 190, Dorset P0A 1E0	(705) 766-2494
Southeastern	B.S. 43, Old Troy Road, Tweed K0K 3J0	(613) 478-2330
Southwestern	Box 5463, 659 Exeter Rd., London N6A 4L6	(519) 661-2773
Sudbury	6th Floor, 200 Brady St., Sudbury P3A 5W2	(705) 675-4441


56°
96°
90°
Manitoba
Severn
River
Winisk
River
PORCUPINE
Attawapiskat
River
52°
RED LAKE
PATRICIA
Albany
River
Red Lake
Moose River
THUNDER BAY
Sioux Lookout
Kenora
KENORA
Mattagami
River
Abitibi R.
Quebec
Thunder Bay
Timmins
Kirkland Lake
48°
U.S.A.
SAULT STE. MARIE
LARDER LAKE
Sudbury
SUDBURY
46°
SOUTHERN ONTARIO
St. Lawrence River
Toronto
U.S.A.
Lake St. Clair
42°
0 50 100 150 mi
0 100 200 km

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MINING DIVISION	MINING RECORDER	ADDRESS
RED LAKE	(807) 727-3264	P. O. BOX 324 ONT. GOV'T BLDG. RED LAKE P0V 2M0
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PATRICIA	(807) 737-2034	P. O. BOX 3000 COURT HOUSE BLDG. SIOUX LOOKOUT P0V 2T0
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PORCUPINE	(705) 267-1401	60 WILSON AVE. TIMMINS P4N 2S7
SUDBURY	(705) 675-4441	200 BRADY ST. 6TH FL. SUDBURY P3A 5W2
LARDER LAKE	(705) 567-9242	4 GOVERNMENT RD. E. KIRKLAND LAKE P2N 1A2
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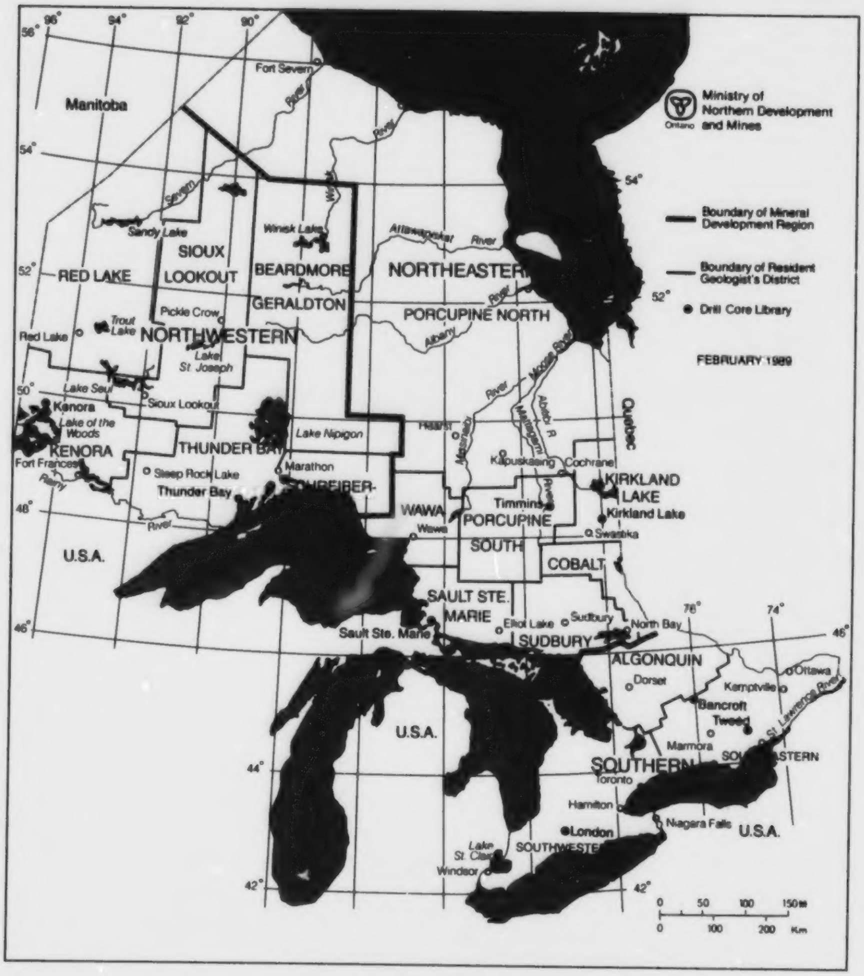
February 1989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Winisk Lake
Pickle Crow
Red Lake
Trout Lake
Lake St. Joseph
Lake Seul
Kenora
Sioux Lookout
Lake of the Woods
KENORA
Fort Frances
Sleep Rock Lake
Thunder Bay
THUNDER BAY
Lake Nipigon
Marathon
SCHREIBER
WAWA
Wawa
Hearst
Kapuskasing
Cochrane
Timmins
PORCUPINE
SOUTH
KIRKLAND LAKE
Kirkland Lake
Swastika
COBALT
Quebec
SAULT STE. MARIE
Sault Ste. Marie
Elliot Lake
Sudbury
SUDBURY
North Bay
ALGONQUIN
Dorset
Bancroft
Tweed
Marmora
Kemptville
Ottawa
SOUTHERN
SOUTHEASTERN
Toronto
Hamilton
London
Niagara Falls
SOUTHWESTERN
Lake St. Clair
Windsor
U.S.A.
U.S.A.
U.S.A.
0 50 100 150 mi
0 100 200 Km

DRILL CORE LIBRARIES

Bancroft	Box 3000, Highway 28 K0L 1C0	(613) 332-4875
Tweed	Box 70, 23 Spring St. K0K 3J0	(613) 478-2330
Sault Ste. Marie	64 Church St. P6A 5L5	(705) 949-1231
Kirkland Lake	Box 129, Swastika P0K 1T0	(705) 642-3222
Timmins	869 Riverside Drive P4N 3W2	(705) 267-1401
Kenora	860 Fourth Ave. S. P9N 2A1	(807) 468-3658
Thunder Bay	335 Euclid Ave. P7E 6G6	(807) 475-1331

PETROLEUM RESOURCES LABORATORY

London	Box 5463, 659 Exeter Rd., N6A 4L6	(519) 661-2796

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
LENGTH					
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
AREA					
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
VOLUME					
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
CAPACITY					
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
MASS					
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
CONCENTRATION					
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in cooperation with the Coal Association of Canada.

1. Northwestern Region Introduction

K.G. Fenwick

Manager, Mineral Resources, Northwestern Ontario Region, Thunder Bay.

The Northwestern Region of the Mines and Minerals Division is made up of six Resident Geologists' Districts and four Mining Divisions which are the Thunder Bay, the Red Lake, the Patricia and the Kenora mining divisions. The region is approximately 700 km by 700 km in size.

The goal of the Mineral Resources Section is to stimulate and monitor exploration, development and production of the mineral resources in the region. This is done by the six Resident Geologist programs which cover the Red Lake, Sioux Lookout, Kenora, Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo districts; the Industrial Minerals Program that covers the entire region; the Drill Core Library Program which is composed of two libraries, one in Kenora and the other in Thunder Bay; and the Historical Research Program.

The Resident Geologist programs provided a professional consultative service, and advice in the office and in the field, to the prospectors, the exploration companies and the public on the geology, the mineral deposits, and the exploration and mining activities in the region. In 1988, over 7000 office consultations were provided to their clientele. The regional Mines and Minerals staff made over 250 field visits to exploration and mining sites. The Resident Geologists' general duties also included the provision of technical information and recommendations to other government agencies (Ministry of Natural Resources, Ministry of The Environment, Ministry of Labour) on land use matters.

Classes for prospectors were conducted in Manitouwadge, Terrace Bay and Geraldton. Posters, depicting the exploration and mining activities in the six Resident Geologists' Districts and in Industrial Minerals in the Northwestern Region, were put on display at three Mines and Minerals Geoscience Seminars; in Toronto, Thunder Bay and Red Lake. A corporate poster, depicting the exploration and mining activities in the enitre region, was presented at the Institute on Lake Superior Geology Annual Meeting, in Marquette, Michigan, and at the 1988 Current Activities Forum of the Minnesota Department of Natural Resources, in Chisholm, Minnesota.

Reports were started or continued on research into, and field visits to, the mineral occurrences in the Birch–Confederation Lakes area, the Schreiber–Marathon area, the Fort Hope–Miminiska Lake area, the Mosher Bay–Stormy Lake area, and the North Caribou and Central Uchi metavolcanic belts. Satellite field offices were maintained in Beardmore, Geraldton and Marathon, and a summer office was maintained in Pickle Lake.

The Historical Research Program was funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement of the Economic Regional Development Agreement signed by the governments of Canada and Ontario, and in 1988 researched the Northern Miner from January 1939 through December 1945, for articles on mineral occurrences and prospects in the Beardmore–Geraldton area. These articles were added to the Beardmore–Geraldton Mineral Deposit files. Several unstaked occurrences were identified through this program and were subsequently staked by explorationists who researched our files.

The staff of the Thunder Bay Drill Core Library collected 9756 m of diamond–drill core from 13 occurrences, prospects and mines in the Thunder Bay Mining Division during 1988. The staff from the Kenora Drill Core Library collected, from December 1, 1987 through November 20, 1988, 14 994.2 m of core: 3613.0 m from Patricia Mining Division; 6027.7 m from Kenora Mining

Division; and 5352.6 m from Red Lake Mining Division. Much of the core in this library is from recent gold exploration, although some emphasis has been placed on collecting core from the more remote parts of region and from old mines sites.

Exploration in the Northwestern Region in 1988 continued at a fast pace. Gold exploration accounted for more than 80 percent of this activity. However, the number of companies and individual prospectors researching base metals, platinum group metals and dimension stone occurrences has increased recently. There has also been some interest shown in tantalum, gallium, lithium and rare earth elements. In all, there were over 500 active exploration programs in the region in 1988. Of these, 28 were in the advanced exploration stage, with 13 of them being underground.

It has been another excellent year for production of gold in the Northwestern Region. The combined production from the seven operations: the Golden Giant, the David Bell, the Page–Williams, the Golden Patricia, the Campbell Red Lake, and the Arthur W. White mines; and the Pan–Empire Mill and ore–sorter (ore from two mine dumps), was over 1.25 million ounces of gold. The Golden Patricia Mine was placed in full production on October 1, 1988. Ateba Mines Inc. officially opened their Pan–Empire Mill in May of 1988. The Dona Lake Mine of Placer Dome Inc., 11 km southeast of Pickle Lake, is expected to be in full production in the second quarter of 1989.

Four base–metal mines, the Mattabi, the Lyon Lake, the Winston Lake and the Geco mines, were in production during the year. The Winston Lake Mine of Minnova Inc. officially opened on July 27, 1988. The Mattabi Mine of Mattabi Mines Limited exhausted its ore reserves and shut down in September of 1988. The rise in base–metal prices has prompted Inco Limited to reopen the Shebandowan Mine in January, 1989.

Three granite dimension stone quarries, two pink and one white, were in production. Active mining at eight amethyst deposits near Thunder Bay continued on a seasonal basis. Other industrial minerals produced in the region include white quartz and diabase, and small quantities of soapstone and marble.

2. Kenora Resident Geologist's District—1988

C.E. Blackburn[1], M.R. Hailstone[2], J. Parker[3], and C.C. Storey[4]

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INTRODUCTION

Exploration for gold continued to be the major activity in the Kenora Resident Geologist's District throughout 1988, with approximately 100 projects by prospectors and mineral exploration companies underway. Advanced exploration, with underground development, was conducted on two properties, the Nuinsco Resources Limited–Echo Bay Mines Limited joint venture at Cameron Lake, and the Madeleine Mines Limited–Boise Cascade Canada joint venture at the old Scramble Mine outside Kenora. No further underground work was done at Consolidated Professor Mines Limited's Duport Mine property at Shoal Lake. Exploration was also conducted in the district for platinum group metals and base metals.

Production of dimension stone by Nelson Granite and Granite Quarriers (G.Q.I.) Incorporated, continued at two quarries, both in Docker Township. Crystal Quarries Limited continued to produce white quartz decorative stone from a quarry 30 km south of Vermilion Bay.

From the Resident Geologist's Office, Kenora, the third year of a four–year program to produce Geological Data Inventory Folios (GDIFs) was underway, as was the second year of a three–year Mineral Commodity Geologist program for the Dryden area. The GDIF program is part of the five year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. Ongoing programs from the Kenora office included acquisition of exploration diamond–drill core from Kenora, Red Lake, and Patricia mining divisions; an assessment of the platinum group metal potential of the district; and monitoring of exploration activity in general.

MINING ACTIVITY

There was no precious or base metal production from mining in the Kenora District in 1988.

DIMENSION STONE

Production of pink granite dimension stone continued at two quarries in Docker Township, adjacent to the Trans–Canada Highway 12 km west of Vermilion Bay. Nelson Granite, a division of Nelson Monuments Limited, Sussex, New Brunswick, operated throughout 1988. Most of the stone from this quarry was shipped as rough blocks to eastern Canada, and to various destinations in the United States, for monumental and architectural applications. Production in 1988 was comparable with 1987 at 3000 m^3, of which approximately 450 m^3 was processed at the finishing plant on the site (C. Nelson, Nelson Granite, Vermilion Bay, personal communication, 1988).

Granite Quarriers (G.Q.I.) Incorporated, of Beebe, Quebec, operated for part of 1988, producing 900 m^3 of stone. All blocks were shipped to eastern Canada and the United States for processing as monumental and architectural stone (R. Cloutier, Quarryman, Granite Quarriers (G.Q.I.) Incorporated, Vermilion Bay, personal communication, 1988).

DECORATIVE STONE

Crystal Quarries Limited extracted white quartz from a vein located adjacent to a forest access road about 30 km due south of Vermilion Bay. The vein is exposed in an area 35 m by 40 m. The quartz was produced for use as exposed aggregate in precast concrete panels.

SMALL SCALE MINING

A. Kozowy (Prospector, Dryden) established a small test mill at the Flambeau Lake Prospect in Van Horne Township. The mill, which consists of a jaw crusher, batch mill, sluice box, and Vardax Accelerator, has produced approximately 100 ounces of gold (A. Kozowy, Prospector, personal communication, 1988).

ADVANCED EXPLORATION AND DEVELOPMENT

CONSOLIDATED PROFESSOR MINES LIMITED, SHOAL LAKE

Following considerable underground and surface exploration at the Duport Mine, the Shoal Lake gold property of Consolidated Professor Mines Limited, in 1987, no further exploration was conducted in 1988.

Results of a feasibility study, commenced by Wright Engineering Limited in late 1987, have indicated mineable reserves to be 902 400 tons grading 0.35 ounce gold per ton (The Northern Miner, June 27, 1988). Overall "geological mineral reserves" are over 2 000 000 tons grading 0.35 ounce gold per ton, according to a press release dated August 28, 1988. At that time, geotechnical and engineering site work was being undertaken for tailings areas, plant sites, power lines, and other facilities.

NUINSCO RESOURCES LIMITED-ECHO BAY MINES LIMITED, CAMERON LAKE

The joint venture partnership of Nuinsco Resources Limited and Echo Bay Mines Limited continued its underground exploration program at its Cameron Lake gold property. With Echo Bay Mines Limited as operator, the second stage of underground exploration that commenced in November 1987 was continued into 1988. Prior to commencement of the underground program, the latest drill-indicated reserves (announced in a press release dated January 20, 1986) were 1 625 000 tons grading 0.16 ounce gold per ton, to a depth of 1100 feet, of which 1 000 000 tons graded 0.23 ounce gold per ton, including a higher grade component of 516 000 tons grading 0.258 ounce gold per ton.

Funding for the second stage of the underground program was initially $6.75 million, provided entirely by Echo Bay Mines Limited by purchase of flow through shares. Plans were to extend the ramp (which had been excavated to the 365-foot level in the first stage of the program) to the 750-foot level, with exploration drifts at various levels to establish drilling stations to test the deposit down to approximately 1600 feet.

In a March 16, 1988 press release, Nuinsco Resources announced that Echo Bay had provided an additional $1.1 million, through purchase of flow through shares, to fund the driving of drifts on the 490- and 685-foot levels, and that the ramp was now at a vertical depth of 685 feet. By the provision of this funding, and an additional amount to conduct surface exploration on other adjacent properties, Echo Bay earned a 51.14 percent interest in Nuinsco Resources.

By the end of May 1988, 62 000 feet of underground diamond drilling had been completed from the ramp and from drifts on the 365-, 490-, and 685-foot levels. Total footage for the ramp and drifts was 9500 feet. In an August 29, 1988 press release, it was announced that further deep drilling below the 685-foot level had indicated continuity of the ore zone to depth. Gold had been encountered in drillholes cutting quartz breccia veins varying in widths from 5 to 40 feet, with grades in some intersections exceeding 0.25 ounce gold per ton. Free gold had been found in quartz-rich zones in drifts, but was rarely seen in drill core.

An ore sampling and evaluation program was conducted by Strathcona Mineral Services Limited during the 1988 summer months. About 12 000 tons of ore, stockpiled on surface from the 365-, 490-, and 685-foot levels, was passed through a sampling tower designed to pulverize and blend the ore. A mining feasibility study was carried out by Wright Engineering Limited utilising all available data, including the bulk sample results obtained from the Strathcona program.

By the fall, it was reported (The Northern Miner, October 31, 1988) that the feasibility study indicated mineable reserves to be 788 000 tons grading 0.194 ounce gold per ton. Taking into consideration estimated capitalization costs of $30.5 million, a 500 ton per day milling rate with a projected 4.5 year mine life, and costs of $67.50 per ton, the study determined that the "deposit requires a minimum gold price of US$550 per ounce in order to be economic." However, the deep drilling had indicated that between the 600- and 800-foot levels the main mineralized zone widens, and remains open below 800 feet, and along strike.

In press releases dated November 23, 1988, Echo Bay and Nuinsco announced that the former's controlling 53.8 percent interest in the latter would be sold to Deak International Resources Limited, and that Deak International, in a separate transaction, would purchase shares in Nuinsco Resources, the proceeds to be used to continue development at the Cameron Lake property.

MADELEINE MINES LIMITED-BOISE CASCADE CANADA, KENORA

Following surface exploration and diamond drilling, between 1984 and 1987, on its wholly-owned Scramble Mine gold prospect 10 km northeast of Kenora, Boise Cascade Canada, in a joint venture with Madeleine Mines Limited, commenced an underground exploration program late in 1987, with Madeleine Mines as operator. Surface drilling had outlined a zone 1200 to 1500 feet long grading approximately 0.15 ounce gold per ton across 12 feet (The Northern Miner, July 25, 1988).

TABLE 2.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	3,531	2,639	12,694	119,947	267,990	16,957	443,554
1987	5,211	2,578	12,496	86,321	153,077	12,067	251,465
1986	4,041	5,054	9,863	64,099	47,883	9,698	144,837
1985	2,216	5,195	10,875	55,090	185,148	29,765	292,729
1984	3,261	3,042	13,854	36,055	281,359	23,670	364,692
1983	11,061	1,472	13,635	35,746	42,221	12,006	106,397
1982	1,579	1,609	4,046	23,525	26,270	5,330	68,439
1981	2,121	846	4,076	26,127	37,624	3,383	72,732
1980	1,877	788	3,208	15,428	3,149	859	21,368
1979	984	1,357	2,119	9,992	10,658	1,420	24,182
1978	808	1,357	2,300	22,299	7,576	2,143	34,934
1977	1,495	1,585	2,820	15,405	11,366	1,760	33,838
1976	1,380	2,125	3,234	25,030	21,367	5,960	55,042
1975	1,677	2,452	3,975	23,584	31,509	940	57,266
1974	2,653	1,076	4,727	29,496	18,049	3,070	52,134

Following excavation of the portal late in 1987, the driving of a decline to the northeast along the ore zone continued through 1988. By July, the ramping had opened a length of over 400 feet, with a cut grade of 0.40 ounce gold per ton across a 5-foot width (The Northern Miner, July 25, 1988). At the end of November, drifting was being done both to the northeast and to the southwest, at the 125-foot level, to investigate high-grade ore encountered while driving the decline (J.P. Sheridan, President, Madeleine Mines Limited, personal communication, 1988).

EXPLORATION ACTIVITY

The level of exploration activity in the Kenora District was as high as it had been in recent years, as indicated by assessment credits listed in Table 2.1.

Gold remained the commodity most sought after, and as has been the pattern since about 1983. The search was concentrated in four major areas: Kakagi–Rowan–Pipestone lakes; Lake of the Woods–Shoal Lake; Manitou–Wabigoon–Eagle lakes; and Fort Frances–Mine Centre. However, continued interest was evident in the Rickaby–Eagle lakes area, and there was new interest in the Umfreville–Treelined lakes area, both north of Kenora. The former area, in the extreme northwestern portion of the district, is across the border from the active Rice Lake greenstone belt in Manitoba, while the latter area straddles the Separation Lake greenstone belt, where little exploration has been conducted for gold in the past.

Interest in platinum group metals continued in 1988, with exploration conducted over a number of mafic to ultramafic intrusions throughout the Kenora District: the Mulcahy Lake Intrusion, 40 km southwest of Dryden; the Entwine Lake Intrusion, 60 km south of Dryden; and ultramafic–mafic lenses along the Werner–Rex Lake lineament, 50 km north of Kenora.

The level of base-metal exploration picked up a little, with renewed interest in copper and nickel, but no major new exploration programs were mounted.

There was considerable interest in stone products, particularly within the Winnipeg River Subprovince granitic rocks north of Kenora (*see* Kennedy and Sherlock, this volume), and graphite mineralization was investigated at Treelined Lake, 60 km north of Kenora.

GOLD

Lake of the Woods–Shoal Lake Area

Exploration for gold in the Lake of the Woods metavolcanic–metasedimentary belt has increased in the last year as a result of COMDA-supported geological investigations by the Ontario Geological Survey, and because of the success of St. Joe Gold Corporation (now Bond Gold Canada Incorporated) in delineating a mineralized zone at Bag Bay, Shoal Lake. Most of the work has been concentrated in the western portion of the belt, around the Canoe Lake Stock, and in proximity to the Duport Deformation Zone (Smith 1986), and the Crowduck Lake–Rush Bay Lineament.

Bond Gold Canada Incorporated, formerly St. Joe Gold Corporation, continued its exploration at Shoal Lake, mostly on patented ground that includes the past-producing Mikado and Cedar Island (Cornucopia) mines among other gold prospects. Work done during the year had earned the com-

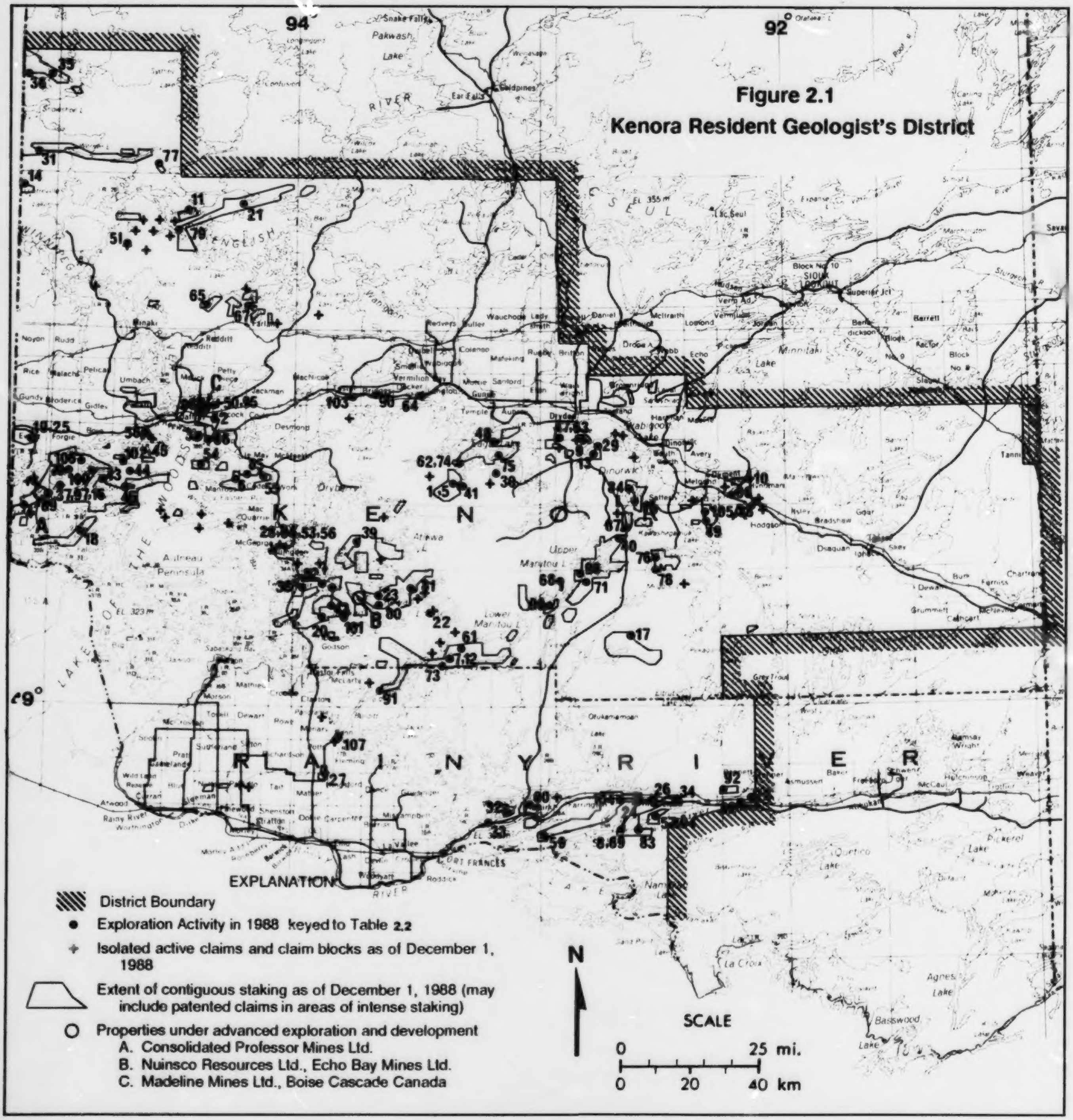


Figure 2.1
Kenora Resident Geologist's District

EXPLANATION

- ▨ District Boundary
- ● Exploration Activity in 1988 keyed to Table 2.2
- + Isolated active claims and claim blocks as of December 1, 1988
- Extent of contiguous staking as of December 1, 1988 (may include patented claims in areas of intense staking)
- ○ Properties under advanced exploration and development
  - A. Consolidated Professor Mines Ltd.
  - B. Nuinsco Resources Ltd., Echo Bay Mines Ltd.
  - C. Madeline Mines Ltd., Boise Cascade Canada

94°
92°
Pakwash Lake
Snake Falls
Ear Falls
Goldpines
RIVER
ENGLISH
LAC SEUL
EL 355 m
Lac Seul
SIOUX LOOKOUT
Minnitaki Lake
Dryden
Wabigoon
Dinorwic
Upper Manitou L
Lower Manitou L
Atikwa L
Aulneau Peninsula
LAKE OF THE WOODS
EL 323 m
KENORA
RAINY RIVER
Rainy River
FORT FRANCES
RIVER
Quetico Lake
La Croix
Agnes Lake
Basswood Lake
Pickerel Lake
Nym Lake
49°
A
B
C
N
SCALE
0
25 mi.
0
20
40 km

TABLE 2.2. EXPLORATION ACTIVITY DURING THE YEAR.

AEM - Airborne electromagnetic survey
AMag - Airborne magnetometer survey
ARad - Airborne radiometric survey
BS - Beneficiation studies
DD - Diamond drilling
EM - Electromagnetic survey
Geochem - Geochemical survey
Geophys - Geophysical survey
GL - Geological survey
IP - Induced polarization survey
Mag - Magnetometer survey
OVD - Overburden drilling
Rad - Radiometric survey
Res - Resistivity survey
SA - Sampling and assaying
SD - Shaft dewatering
SP - Self Potential
STr - Power stripping and manual stripping
Tr - Trenching
UGDD - Underground diamond drilling

TABLE

Number on Figure	Individual or Company	Activity	
1	697895 Ontario Ltd.	Line Lake	AEM, AMag, GL, STr, Tr, SA
2	745065 Ontario Ltd.	Haycock Township	DD, STr
3	784296 Ontario Ltd.	Jaffray Township and Kirkup Township	STr
4	Almaden Resources Corp.	Snowshoe Bay and Moosin Bay	EM, DD
5	American Platinum Inc.	Line Lake	Mag
6	Anyox Metals Ltd.	Manross Township	DD
7	Anyox Metals Ltd.	Bluffpoint Lake	DD
8	Armstrong, George	Bad Vermilion Lake	DD
9	Asarco Exploration Co. of Canada Ltd.	Van Horne Township	EM
10	Asarco Exploration Co. of Canada Ltd.	Revell Township	EM
11	Bellwether Resources Ltd.	Treelined Lake	BS, EM, Mag
12	Bolen, John A.	Bluffpoint Lake	Mag, DD
13	Bond Gold Canada Inc.	Contact Bay	EM, Mag, IP
14	Bond Gold Canada Inc.	West of Umfreville Lake	EM, Mag
15	Bond Gold Canada Inc.	Turtlepond Lake	AEM, AMag, EM, Mag
16	Bond Gold Canada Inc.	Glass Township	DD
17	BP Resources Canada Ltd.	Eagle Rock Lake	GL, SA, DD
18	BP Resources Canada Ltd.	Monument Bay	AEM, AMag
19	Busch, David	Ewart Township	OVD
20	Canadian Nickel Company Ltd.	Heronry Lake	DD, SA
21	Champion Bear Resources Ltd.	Lennan Lake, Treelined Lake, and Campfire Lake	EM, Mag
22	Claggett, Robert	Lawrence Lake	STr
23	Colby Resources Corp.	Rowan Lake	EM, Mag
24	Coldspring Resources Ltd.	Little Turtle Lake	STr
25	Consolidated Jalna Resources Ltd.	Ewart Township	DD
26	Cousineau, Louis	Little Turtle Lake	Tr
27	Cummings, Walter M.	Mather Township and Potts Township	GL
28	Dubenski Gold Mines Ltd.	Dogpaw Lake	SD, UGDD
29	Eagle Lake Resources Ltd.	Contact Bay	EM, Mag, GL
30	Eagle Lake Resources Ltd.	Buchan Bay	EM, Mag, GL
31	Falcon Point Resources Ltd.	Reynar Lake	DD
32	Falconbridge Ltd.	Watten Township	GL, Geochem
33	Falconbridge Ltd.	Watten Township	Rad
34	Fire River Gold Corp.	Bennett Lake	SA
35	Gandy Resources Corp.	Rickaby Lake and Eagle Lake	EM, Mag
36	Gold Fields Canadian Mining Ltd.	Rickaby Lake and Eagle Lake	AEM, AMag
37	Golden Rule Resources Ltd.	Glass Township	EM, Mag, DD
38	Granges Exploration Ltd.	Tweedsmuir Township	DD
39	Granges Exploration Ltd.	Lobstick Bay	SA, DD
40	Hall, E. M.	Boyer Lake	SA, Tr
41	Hansen, Edward	Line Lake	STr
42	Hinzer, J., Ternowesky, J.	Dogpaw Lake	AEM, AMag
43	Homestake Mineral Development Corp.	Shoal Lake	GL

TABLE 2.2 Continued

Number on Figure	Individual or Company	Activity	
44	Homestake Mineral Development Corp.	Wiley Bay and Clearwater Bay	GL, Geochem, DD, EM, Mag
45	Homestake Mineral Development Corp.	Clearwater Bay	SA
46	International Nickel Co. Ltd.	Shoal Lake and Wiley Bay	GL, Mag, DD
47	International Platinum Corp.	Van Horne Township and Aubrey Township	DD
48	International Platinum Corp.	Buchan Bay, Aubrey Township and Temple Township	EM, Mag, DD
49	International Platinum Corp.	Tabor Lake and Kawashegamuk Lake	DD, SA
50	Kenora Gold Occurrences Inc.	Jaffray Township and Haycock Township	EM, Mag
51	Kenora Gold Occurrences Inc.	Snook Lake	GL, Rad
52	Kroocmo, David	Factor Lake	Tr
53	Lafleche, G.	Dogpaw Lake	Mag
54	Manontex Ltd./Shabu Gold Mines Ltd.	Bigstone Bay	AEM, AMag
55	Manontex Ltd./Shabu Gold Mines Ltd.	Manross Township and Code Township	AEM, AMag
56	Martin, Jack D.	Dogpaw Lake	EM, Mag
57	McCormick, Alan E.	Bad Vermilion Lake	Mag
58	Mingold Resources Inc.	Clearwater Bay	DD
59	Minnova Inc.	Halkirk Township	DD
60	Minnova Inc.	Halkirk Township	DD, SA
61	Minnova Inc.	Bluffpoint Lake	DD
62	Mistango Consolidated Resources Ltd.	Garnet Bay	STr
63	Moss Resources Ltd.	Van Horne Township	DD, SA
64	Nelson, Carter	Docker Township	STr, Tr
65	Nelson, Carter	Forgotten lake	STr, Tr
66	Nelson, Carter	Revell Township	STr
67	Nelson, Carter	Wonderland Lake	Tr
68	Nelson, Douglas B.	Lower Manitou Lake	Geochem, SA
69	Nipigon Gold Resources Ltd.	Bad Vermilion Lake	GL, STr, SA
70	Noranda Exploration Company Ltd.	Glass Township	EM, Mag
71	Noranda Exploration Company Ltd.	Lower Manitou Lake and Boyer Lake	AEM, AMag, ARad
72	Noranda Exploration Company Ltd.	Factor and Hepburn Lakes	STr, GL, Geochem, BS, SA
73	Noranda Exploration Company Ltd.	Kaiarskons and Bluffpoint Lakes	Geochem
74	Noranda Exploration Company Ltd.	Garnet Bay	Geochem, SA
75	Noranda Exploration Company Ltd.	Buchan Bay	AEM, AMag, ARad, EM, Mag
76	Noranda Exploration Company Ltd.	Boyer Lake	AEM, AMag, ARad, DD
77	Noranda Exploration Company Ltd.	Rex Lake	Geochem, SA
78	Noranda Exploration Company Ltd.	Meggisi Lake	DD, SA
79	Noranda Exploration Company Ltd.	Treelined Lake	Geochem, SA
80	Nucanolan Resources Ltd.	Rowan Lake	DD
81	Nuinsco Resources Ltd.	Rowan Lake	DD, SA
82	Nuinsco Resources Ltd.	Dogpaw Lake	GL, DD, SA
83	Orofino Resources Ltd.	Bad Vermilion Lake	GL, SA
84	Peter Island Resources Ltd.	Turtlepond Lake	EM, Mag, DD
85	Pogson, Gordon	Code Township	STr, Tr
86	President Mines Ltd.	Kirkup Township	STr
87	Redden, J.W.	Boyer Lake	EM, Mag
88	Redden, J.W.	Tabor Lake	STr, Tr
89	Redsky, Stewart & Lawrence	Snowshoe Bay	EM, Mag
90	Rio Algom Exploration Inc.	Bridges Township	DD, Geophys
91	Ross Island Resources Inc.	Dash Lake	GL, IP, Res, Mag, SA
92	Royal Crest Resources Ltd.	Bennett Township	Mag
93	Scramble Mining Ltd.	Jaffray Township	EM, Mag

TABLE 2.2 Continued

Number on Figure	Individual or Company	Activity	
94	Seine River Resources Inc.	Bad Vermilion Lake	GL, EM, Mag
95	Sheridan, J.P.	Haycock Township	DD
96	Sherritt Gordon Mines Ltd.	Dogpaw Lake	SA
97	St. Joe Canada Inc.	Glass Township	Mag
98	St. Joe Canada Inc.	Lower Manitou Lake	EM, Mag
99	Teck Exploration Inc.	Lower Manitou Lake	DD
100	Teeshin Resources Ltd.	Shoal Lake	DD
101	Teeshin Resources Ltd./Mountain Lake Resources Inc.	Dogpaw Lake	SA
102	Teeshin Resources Ltd./Whymark, Wayne	Clearwater Bay	SA, DD
103	Thibault, Douglas	Tustin Township	STr
104	Thompson, Larry	Bad Vermilion Lake	EM, Mag
105	Venturex Resources Ltd.	Tabor Lake	DD
106	Voyager Exploration Ltd.	Echo Bay	GL, EM, Mag, STr, SA
107	Watson, M.	Senn Township	EM, IP, Res, SP

pany, in its option agreement with Kenora Prospectors and Miners Limited, a 50 percent interest in the property. It was reported in the Northern Miner (October 24, 1988) that Bond Gold had outlined 950 000 t grading 8.3 g/t gold (0.24 ounce gold per ton from 1 047 195 tons of ore), and that at that time, a 13 000–foot diamond drilling program was underway. The zone under investigation is an extension of the Cedar Island ore zone, and is situated between the old Cedar Island and Mikado mines. Work done by Bond Gold on unpatented claims included a magnetic survey at Helldiver Bay, Shoal Lake.

Other exploration programs in the general Shoal Lake area are discussed in the following paragraphs.

Almaden Resources Corporation, as a follow–up to an airborne electromagnetic (EM) and magnetic survey, conducted a ground EM survey over a claim group targeted on a 5 km long portion of the southwestern end of the Duport Deformation Zone, along the western shore of Shoal Lake from Gull Bay to Twin Point. Another ground EM survey was conducted around Mackey Islands, in the south–central part of Shoal Lake (Assessment Files, Resident Geologist's Office, Kenora). Follow–up diamond drilling was conducted on a number of targets outlined by the surveys.

Teeshin Resources Limited conducted soil and rock geochemical surveys, geologic reconnaissance, and diamond drilling (Assessment Files, Resident Geologist's Office, Kenora) on a 108–claim group straddling the eastern margin of the Canoe Lake Stock, from Shoal Lake in the southwest, to Sherlock Point in Ptarmigan Bay, Lake of the Woods, in the northeast. Following mapping of a shear zone splaying off the Crowduck Lake–Witch Bay shear zone by Ayer (1988a). Teeshin geologists have interpreted a deformation zone, of similar type, and parallel to the Duport Deformation Zone, to underlie the claim group. A geochemical anomaly reported in an article in the CIM Reporter, June 14, 1988, was identified on the Squaw Lake grid, and said to be 1000 m long by 75 m wide with values between 50 and 3000 ppb gold. Silver values coincident with the anomaly ran up to 13.9 ppm. Three diamond–drill holes were put down on this anomaly, for a total of 1773 feet.

Teeshin Resources Limited, in a joint venture with Wayne Whymark, put down one 362–foot long diamond–drill hole on a magnetic high, underlying a small island south of Corkscrew Island identified in a magnetic survey previously performed in 1986 by Homestake Mineral Development Company (Assessment Files, Resident Geologist's Office, Kenora). This also coincided with a breccia zone identified in a geological survey by Ayer (1988a), from which an assay of 1235 ppb gold was obtained. Further geochemical assays by Teeshin gave low ppb results only (Assessment Files, Resident Geologist's Office, Kenora).

Homestake Mineral Development Company diamond–drilled two holes for a total of 1012 feet in the vicinity of the same breccia zone investigated by Teeshin Resources Limited at the southern end of Corkscrew Island. Geochemical analyses for gold were similarly in the low ppb range, apart from two 1 m core lengths that ran 1020 ppb and 1250 ppb gold. Homestake has also continued work on its Fox Lake gold property in the Wiley Bay and Clearwater Bay areas, conducting geological, EM, magnetic, and geochemical surveys; and on a group of claims at the eastern end of Labyrinth Bay in the Shoal Lake area, where it has conducted geological and geochemical surveys.

Voyager Exploration Limited continued work on its Echo Bay claim group that had commenced in 1987, and includes the Echo Bay Adit, Nonesuch, Echola, and Homestead occurrences. Following geological mapping, geophysical surveys, and diamond drilling in 1987, the company acquired additional claims in 1988 and carried out further geological and geophysical surveys, stripping and cleaning out of old trenches, and sampling and assaying.

Noranda Exploration Company, Limited conducted EM and magnetic surveys on a 39–claim group straddling the northwestern margin of the Canoe Lake Stock, from Echo Bay to Clytie Bay (Assessment Files, Resident Geologist's Office, Kenora). Grab samples taken along the southern shore of Echo Bay assayed low values, but one sample ran 29.82 g/t gold.

Golden Rule Resources Limited did further work on a 29–claim block at Bag Bay, Glass Township, immediately adjacent to the Mikado gold property of Bond Gold Canada Incorporated and Kenora Prospectors and Miners Limited, but within the Canoe Lake Stock. In 1987, a five–hole diamond drilling program had tested geophysical and geochemical anomalies, but analyses for gold from the core were uniformly low, except for one sample that returned greater than 1000 ppb gold (Assessment Files, Resident Geologist's Office, Kenora). Work in 1988 consisted of a second EM and magnetic survey of the property, followed by diamond drilling in three holes, all within the Canoe Lake Stock, targeted on shears identified in the geophysical surveys.

Other work in the Shoal Lake area consisted of magnetic and EM surveys conducted on a 23–claim block held by Stewart and Lawrence Redsky, covering islands and lake adjacent to and northeast of Consolidated Professor Mines Limited's Duport Mine property at Stevens Island; diamond drilling by Consolidated Jalna Resources Limited on the Purdex Prospect, Ewart Township; and overburden drilling by D. Busch at the Arsenic Zone Occurrence, Ewart Township.

The other portion of the Lake of the Woods metavolcanic–metasedimentary belt that has received most attention is in the vicinity of Kenora, where the Scramble Mine prospect in Jaffray Township is currently undergoing advanced exploration by Madeleine Mines Limited and Boise Cascade Canada. Scramble Mining Limited, a subsidiary of Boise Cascade Canada, conducted EM and magnetic surveys on unpatented ground adjacent to the Scramble Mine.

Kenora Gold Occurrences Incorporated carried out magnetic and EM surveys on two claim groups close to the Scramble Mine Prospect, one covering the Rajah and Roseman gold prospects in Jaffray Township, and the second covering the Princess and Black Sturgeon prospects in Haycock Township. Stripping in the vicinity of the Princess and Black Sturgeon prospects uncovered a gold–bearing shear zone to the east of the Black Sturgeon shaft. Local newspaper articles (Kenora Daily Miner and News, October 3 and October 27, 1988) indicated that encouraging gold assay values were obtained from surface sampling. Subsequent diamond drilling in six holes east of the Black Sturgeon shaft failed to confirm these values at depth, and two more holes were diamond–drilled near the Princess shaft (Kenora Daily Miner and News, October 27, 1988).

J.P. Sheridan, on an optioned property from G. Pogson, in a three–hole diamond drilling program immediately east of Kenora Gold Occurrences Incorporated's Black Sturgeon Property, obtained only trace gold assay values (Assessment Files, Resident Geologist's Office, Kenora).

Other work done in the Kenora area included diamond drilling by Mingold Resources Incorporated at Abernathy Lake in the Clearwater Bay area; stripping and trenching, and diamond drilling carried out by 745065 Ontario Limited at the Sweden and Gordon gold occurrences in Haycock Township; stripping by 784296 Ontario Limited in Jaffray and Kirkup townships; and stripping by President Mines Limited at the Pine Portage Mine prospect, Kirkup Township.

BP Resources Canada Limited, following release of assay data done during COMDA–funded mapping in the Monument Bay area by Morrice and McMaster (1987) in which preliminary values of up to 870 ppb gold were reported from a northeast–trending deformation zone, obtained a large block of claims along the zone. Subsequently, in 1988, an airborne EM and magnetic survey was flown over 75 claims.

International Nickel Company Limited conducted geological mapping and magnetic surveys on 100 km of gridding, and diamond–drilled 15 holes for a total of 1874 m on its large claim block on Western Peninsula, in the Wiley Bay and Shoal Lake areas (E. Debicki, International Nickel Company Limited, personal communication, 1988).

Manontex Limited and Shabu Gold Mines Limited had EM and magnetic surveys flown over two claim blocks in the northeastern Lake of the Woods area; one of 77 claims at Hay Island, and a second of 111 claims at Gibi Lake (Assessment Files, Resident Geologist's Office, Kenora).

Other work in the Lake of the Woods area included diamond drilling performed by Anyox Metals Limited on its Wendigo Mine option in Manross Township, and stripping and trenching by G. Pogson on one claim in Code Township.

Kakagi–Rowan–Pipestone Lakes Area

The interest generated by activity of the Echo Bay Mines Limited–Nuinsco Resources Limited underground operation at Cameron Lake continued to influence exploration activity in the surrounding area of Rowan Lake and along the Pipestone–Cameron Fault. Companies which were active included Nuinsco Resources Limited (which conducted work on properties other than its Cameron Lake holdings), Colby Resources Corporation, Dubenski Gold Mines Limited, Nucanolan Resources Limited, and Sherritt Gordon Mines Limited.

Nuinsco Resources Limited entered into a joint venture agreement with Canadian Arrow Gold Mines Limited under which Nuinsco can earn a 51 percent interest in the Canadian Arrow gold prospect in the Dogpaw Lake area by expending $750 000 in exploration, according to a news release dated March 16, 1988. Surface work and diamond drilling were done on the property in 1988 (The Northern Miner, June 20, 1988). Nuinsco also resumed work in the vicinity of its wholly-owned Monte Cristo Prospect on Rowan Lake, where it had been inactive since 1986. Diamond drilling was conducted on scattered claims in nine holes, for a total of 5450 feet, and anomalous gold values were encountered in a number of holes (Assessment Files, Resident Geologist's Office, Kenora).

Colby Resources Corporation conducted magnetic and very low frequency electromagnetic (VLF–EM) surveys over a 32–claim block situated between Shingwak Lake and Sullivan Bay, in the Rowan Lake area (Assessment Files, Resident Geologist's Office, Kenora).

Dubenski Gold Mines Limited, following dewatering of the old shaft at its Caswell–Williams gold prospect at Flint Lake in the Dogpaw Lake area, carried out a program of underground drilling in 20 holes to a depth of 350 feet, as a follow–up to diamond drilling programs and surface stripping and sampling conducted by the company since its incorporation in 1983 (J.P. Sheridan, President, Madeleine Mines Limited, personal communication, 1988).

Nucanolan Resources Limited carried out a limited amount of work on the unpatented portion of its ground adjoining, and to the east of, Nuinsco Resources' Cameron Lake property. Four packsack diamond–drill holes were completed (Assessment Files, Resident Geologist's Office, Kenora).

Sherritt Gordon Mines Limited submitted geochemical analyses subsequent to assay data from four diamond–drill holes completed in 1987 on its claim group adjacent to, and east of, the Dubenski Property at Flint Lake. Low, but anomalous, values were obtained from all four holes (Assessment Files, Resident Geologist's Office, Kenora).

Elsewhere in the Kakagi and Rowan lakes area, Granges Exploration Limited and Canadian Nickel Company Limited continued exploration programs, as discussed below.

Granges Exploration Limited worked on two properties. On the first group of claims, which included the Bag Lake (or Jensen–Johnston) Occurrence in Tweedsmuir Township, 4560 feet of diamond drilling was done in 12 holes as a follow–up to magnetic and VLF–EM surveys. The drilling tested a number of targets north and west of Bag Lake. The best assay results were obtained near the original trenches north of Bag Lake. On the second property, at Mushkazu Lake in the Lobstick Bay area, optioned from R. Fairservice, Granges diamond–drilled 15 holes during the winter of 1987–1988.

Canadian Nickel Company Limited continued diamond drilling on its Penn Property at Kakagi Lake in the Heronry Lake area. Ten holes were reported (Assessment Files, Resident Geologist's Office, Kenora) mostly on the East Trench and Rainbow zones. The company has explored this property since 1983, when it was optioned from Welcome North Mines Limited.

Teeshin Resources Limited, in a joint venture with Mountain Lake Resources Incorporated, conducted sampling on an open cut previously excavated by Frances Resources Limited in 1983 on the Wensley Prospect at Wicks Lake in the Dogpaw Lake area.

Other individuals who did work in the Kakagi and Rowan lakes area included R. Clagget who did stripping at Hill Lake in the Lawrence Lake area; J. Hinzer and J. Ternowesky, for whom an airborne magnetic and VLF–EM survey was flown over 60 claims that covered the southwestern margin of the Stephen Lake Stock in the Dogpaw Lake area; G. Lafleche, who conducted a magnetic survey on two claims at the northeastern end of Cedartree Lake in the Dogpaw Lake area; and Jack Martin, who conducted magnetic and VLF–EM surveys on one claim adjacent to those of G. Lafleche.

Further to the southeast, exploration continued near Straw Lake and along a lineament defined by Burditt Lake and the southern arm of Pipestone Lake, by the following companies and individuals.

Minnova Incorporated continued work, in a option agreement with Celebrity Energy Corporation, on its property at the southern end of the Lawrence Lake Batholith in the Bluffpoint Lake area (which includes the Fairservice–Edwards Prospect). The Northern Miner, May 30, 1988, reported that seven diamond–drill holes had been completed, all of which encountered anomalous gold values, and that three separate areas were tested, including the Moose Creek Fault.

Ross Island Resources Incorporated continued geological mapping on its large claim group along the southeastern margin of the Dash Lake Stock on the southern arm of Pipestone Lake in the Dash Lake area. In addition, magnetic, induced polarization (IP), and resistivity surveys were done, and samples were taken for assay (Assessment Files, Resident Geologist's Office, Kenora).

Other work done included soil and rock sampling for geochemical analyses by Noranda Exploration Company, Limited at the Straw Lake Prospect in the Kaiarksons Lake and Bluffpoint Lake area, on claims that are part of a contiguous group of over 600 claims between the northern arm of Pipestone Lake in the west to Manitou Stretch in the east, over which airborne magnetic, EM, and radiometric surveys were flown for the company in 1987 (Assessment Files, Resident Geologist's Office, Kenora); diamond drilling at the former Straw Lake Beach Mine by Anyox Metals Limited in the Bluffpoint Lake area; a magnetic survey and diamond drilling of four holes for a total of 919 feet, by J. Bolen at the eastern end of Straw Lake, north of, and adjacent to, Anyox Metals' holdings; and VLF–EM, IP, resistivity, and self potential surveys by M. Watson at Off Lake, in Senn Township.

Rickaby–Eagle Lakes Area

Interest in the gold potential of the Rickaby–Eagle lakes areas continued in 1988, with two projects active.

Gandy Resources Corporation conducted EM and magnetic surveys on a 109–claim group at Eden Lake and the eastern end of Bee Lake, following geological work done in 1987 (Assessment Files, Resident Geologist's Office, Kenora). The target was gold deposits that might be hosted by iron formation.

Gold Fields Canadian Mining Limited conducted airborne EM and magnetic surveys over two claim blocks, one of 190 claims in the Rickaby Lake area, and the other of 18 claims in the Eagle Lake area (Assessment Files, Resident Geologist's Office, Kenora). These two blocks lie on either side of the Gandy Resources property, the first over Anderson and Rickaby lakes, and the western end of Bee Lake; and the second between Eden and Eagle lakes.

Umfreville–Treelined Lakes Area

Champion Bear Resources Limited is known to have conducted EM and magnetic surveys over a block of 364 claims centred on Helder Lake in the Lennan Lake, Treelined Lake, and Campfire Lake areas.

Bond Gold Canada Incorporated is known to have conducted EM and magnetic surveys on a 16–claim group in the West of Umfreville Lake Area. This area, at the Manitoba border, is probably on a continuation of the Separation Lake greenstone belt.

Manitou–Wabigoon–Eagle Lakes Area

Teck Corporation, in a joint venture with San Paulo Explorations Incorporated, completed a seven–hole drilling program at the old Gaffney Prospect on Manitou Island in Lower Manitou Lake. Teck previously delineated a 400 m long gold–bearing zone on the property (The Northern Miner, December 14, 1987). Results of the drilling increased the estimation of overall tonnage at the Gaffney Prospect to 300 000 tons grading 0.15 ounce gold per ton with some drill intersections assaying 0.347 ounce gold per ton across 17.1 feet, 0.214 ounce gold per ton across 13.5 feet, and 0.439 ounce gold per ton across 3 feet (The Northern Miner, May 9, 1988).

D.A. Nelson conducted geological mapping and rock and soil sampling over his claims encompassing the Dryden–Red Lake Prospecting Syndicate Occurrence near Early Lake, in the Lower Manitou Lake area. Previous chip sampling in test pits at the occurrence gave assays as high as 0.45 ounce gold per ton across 4 feet (Thomson 1934). Chip samples taken from pits at the occurrence by D.A. Nelson assayed as high as 0.81 ounce gold per ton across 90 cm with weighted average grades of up to 0.33 ounce gold per ton across 2.3 m (Assessment Files, Resident Geologist's Office, Kenora).

Noranda Exploration Company, Limited continued exploration programs on its extensive claim holdings in the Manitou–Stormy lakes belt. In a joint venture with River Oaks Gold Corporation, Noranda conducted airborne magnetic, EM, and radiometric surveys over approximately 300 claims at Lower Manitou Lake and in the vicinity of Mosher Bay on Upper Manitou Lake, in the Lower Manitou Lake and Boyer Lake areas (Assessment Files, Resident Geologist's Office, Kenora). In a joint venture with Tundra Gold Mines Limited, Noranda flew the same airborne surveys over approximately 150 claims that include the Pelham Prospect at Washeibemaga Lake in the Boyer Lake area (Assessment Files, Resident Geologist's Office, Kenora).

Noranda and Tundra Gold Mines Limited also drilled 27 holes totalling 2935.7 m at the Pelham Prospect, southwest of Washeibemaga Lake, in the Boyer Lake area (Assessment Files, Resident Geologist's Office, Kenora). The Pelham Prospect was originally discovered in 1937 and exploration continued intermittently at the prospect between 1938 and 1974 (Blackburn 1981a). The majority of Noranda's drilling was targeted on the No. 3 zone, where drill intersections such as 0.16 ounce gold per ton across 3 m and 0.12 ounce gold per ton across 2 m were encountered (Tundra Gold Mines Limited, News Release, March 21, 1988). The companies also drilled an 80 m hole at the Patterson, or Renders, Occurrence situated at Thundercloud Lake in the Meggisi Lake area (Assessment Files, Resident Geologist's Office, Kenora).

E.M. Hall conducted stripping and sampling at the Little Master Prospect northwest of Kabagukski Lake near Goldrock in the Boyer Lake area. The property consists of two old shafts and a number of trenches sunk during the early 1900s (Mineral Deposit Files, Resident Geologist's Office, Kenora). A sample taken by E.M. Hall from a trench on the property assayed 0.12 ounce gold per ton (Assessment Files, Resident Geologist's Office, Kenora).

J. Redden conducted ground VLF–EM and magnetic surveys over his claims at Sasakwei Lake in the Boyer Lake area, where numerous old pits and trenches have been found (Assessment Files, Resident Geologist's Office, Kenora).

Bond Gold Canada Incorporated conducted airborne magnetic and VLF–EM surveys, and ground magnetic, VLF–EM, and horizontal–loop electromagnetic (HLEM) surveys over its claim group at Whitewater Lake in the Turtlepond Lake area, where numerous gold occurrences have recently been discovered (Assessment Files, Resident Geologist's Office, Kenora; Blackburn *et al.* 1988, p.19–20).

Peter Island Resources Incorporated conducted ground VLF–EM and magnetic surveys over its group of 44 claims at Moose Bay of Dinorwic Lake in the Turtlepond Lake area. The claim group encompasses the old Van Houten, or Alston Lake, gold prospect. Three diamond–drill holes totalling 1347 feet were targeted on old pits and trenches on the property (Assessment Files, Resident Geologist's Office, Kenora).

International Platinum Corporation continued exploration work on its claims at Brown and Church lakes in the Tabor Lake and Kawashegamuk Lake areas. The company drilled 13 holes totalling 4248 feet targeted on the Brockman Prospect north of Brown Lake in the Tabor Lake area, and on the Church Lake occurrences on the eastern shore of Church Lake in the Kawashegamuk Lake area. The best drill intersections reported were 1.12 ounces gold per ton across 0.7 feet and 0.036 ounce gold per ton across 0.9 feet in two holes drilled at Church Lake (Assessment Files, Resident Geologist's Office, Kenora).

Venturex Resources Limited (formerly RCJ Resources Limited) completed a diamond drilling program (initiated in 1987) consisting of ten holes totalling 4000 feet at the former Sakoose Mine in the Tabor Lake area (RCJ Resources Limited, News Release, December 17, 1987; Northern Miner, March 7, 1988). The mine produced about 3669 ounces of gold from 8828 tons of ore milled during the early 1900s and late 1940s (Mineral Deposit Files, Resident Geologist's Office, Kenora). The drilling program extended the gold–bearing zone to a vertical depth of 525 feet and 525 feet downplunge from the lowest mine workings. Some of the best drill intersections assayed 0.3 ounce gold per ton across 22.3 feet, 0.41 ounce gold per ton across 9.2 feet, and 0.6 ounce gold per ton across 1.7 feet (The Northern Miner, March 7, 1988). Later in 1988, 11 holes were diamond–drilled on the property, for a total of 5054 feet, to test 1150 feet of strike length and 620 feet of dip length of the main vein at 164–foot intervals (George Cross News Letter, November 23, 1988). One of the holes intersected 1.55 ounces gold per ton over a true width of about 3.5 feet.

J. Redden conducted stripping and trenching in the vicinity of the Sakoose Mine and the Maw Occurrence in the Tabor Lake area, where he has been working for the last several years (Assessment Files, Resident Geologist's Office, Kenora).

Asarco Exploration Company of Canada Limited conducted a ground VLF–EM survey over a small group of claims encompassing the H.W.673 Occurrence in Revell Township (Assessment Files, Resident Geologist's Office, Kenora). The property consists of a shaft sunk on a quartz–feldspar porphyry dike, intruding mafic metavolcanic rocks, and hosting quartz veins and stringers.

Eagle Lake Resources conducted ground magnetic and VLF–EM surveys over its 16–claim block near Mile Lake in the Contact Bay area, where it is exploring for gold and platinum group metals (Assessment Files, Resident Geologist's Office, Kenora). The company also conducted geological mapping of the claims.

Bond Gold Canada Incorporated conducted airborne magnetic and EM surveys, and ground VLF–EM, IP, and magnetic surveys over its claims east of Trap Lake in the Contact Bay area (Assessment Files, Resident Geologist's Office, Kenora). The claims encompass the Pidgeon–Trap Lake gold occurrence.

Asarco Exploration Company of Canada Limited conducted geological mapping, sampling, and a ground VLF–EM survey over its claims along the southern shore of Larson Bay of Wabigoon Lake in Van Horne Township. Asarco located numerous quartz veins during the mapping. A sample from one of the veins assayed 0.125 ounce gold per ton (Assessment Files, Resident Geologist's Office, Kenora).

International Platinum Corporation drilled 35 holes totalling 12 000 feet at the Flambeau Lake Prospect in Van Horne and Aubrey townships (L. Burden, Geologist, International Platinum Corporation, personal communication, 1988). The prospect consists of numerous, high–grade, gold–bearing quartz veins and has been explored by several other exploration companies during the past few years.

Moss Resources Limited (formerly Van Horne Gold Exploration Incorporated) continued an extensive drilling program on its claims in Van Horne Township during the early part of 1988, to follow–up promising results obtained at the Vanlas Prospect in 1987. Mineralized intersections obtained during a 1987 drilling program, such as 0.26 ounce gold per ton across 24.6 feet (The Northern Miner, May 18, 1987), encouraged the company to drill 123 holes totalling 46 817.5 feet (Assessment Files, Resident Geologist's Office, Kenora). Drilling delineated a gold–bearing zone at the Vanlas Prospect with a mineral reserve estimated at 55 000 tons grading 0.30 ounce gold per ton with a cut–off grade of 0.10 ounce gold per ton. Drilling and other exploration work conducted elsewhere on the property outlined numerous gold–bearing zones that require further work. The company has expended a total of $245 000 on exploration costs to date.

Noranda Exploration Company, Limited conducted ground magnetic and HLEM surveys over its claims which encompass the W.W. Smith Prospect at Hardrock Bay on Eagle Lake in the Buchan Bay area, where it has been working since 1987. Noranda also conducted airborne magnetic, EM, and radiometric surveys over 127 claims in the same area (Assessment Files, Resident Geologist's Office, Kenora). Noranda conducted lithogeochemical and humus sampling on its Buffalo Prospect claims in the Garnet Bay area at Eagle Lake, which consist of an adit and two shallow shafts (Mineral Deposit Files, Resident Geologist's Office, Kenora). Noranda obtained some anomalous gold values from the humus sampling which analyzed as high as 420 ppb gold (Assessment Files, Resident Geologist's Office, Kenora).

Eagle Lake Resources conducted ground magnetic and VLF–EM surveys over its claims which encompass a small gold occurrence on the northern shore of Meridian Bay of Eagle Lake in the Buchan Bay area (Assessment Files, Resident Geologist's Office, Kenora). The company also conducted geological mapping of the claims.

Mistango Consolidated Resources Limited conducted stripping between the adit and shaft at the Grace Mine on Eagle Lake in the Garnet Bay area where it has been working for the past several years (Assessment Files, Resident Geologist's Office, Kenora). Other persons and companies known to have done exploration for gold in the general Manitou–Wabigoon–Eagle lakes area in 1988 included ground VLF–EM and magnetic surveys in the Lower Manitou Lake area by St. Joe Canada Incorporated (now known as Bond Gold Canada Incorporated); geological work on Net Island in the Buchan Bay area by Eagle Lake Resources Limited; and stripping in the Silvery Lake area by D. Thibault.

Fort Frances–Mine Centre Area

The Bad Vermilion Lake area, south of Mine Centre, was by far the most active, with six exploration projects underway. Orofino Resources Limited continued work on its 128–claim Seine River Block, over the southern half of Shoal Lake, with a geological mapping and sampling program (W. Gowdy, Geologist, Orofino Resources Limited, personal communication, 1988). In the same area, G. Armstrong diamond–drilled 11 holes on patented claim JO42, testing for the attitude of a quartz vein exposed in a surface trench; and one hole on each of contiguous patented claims K.74 and K.75. A six–foot intersection from a diamond–drill hole on JO42 assayed 0.84 ounce gold per ton (G. Armstrong, Property Owner and Operator, personal communication, 1988). In the same area, on the MacKenzie–Gray Occurrence, Nipigon Gold Resources Limited carried out a geological mapping, stripping, sampling and bulk sampling program. A 110–pound bulk sample from the property gave the following analyses: on 60 pounds of massive sphalerite—21.7 g/t gold, 49.0 g/t silver, 0.47 percent copper, and 39.3 percent zinc; and on 50 pounds of quartz–vein material—34.8 g/t gold, 68.2 g/t silver, 0.72 percent copper, and 0.91 percent zinc (Max Reiter, President, Nipigon Gold Resources Limited, personal communication, 1988).

Seine River Resources carried out geological mapping and EM and magnetic surveys on its claims which cover the Dinosaur and Smylie occurrences (Assessment Files, Resident Geologist's Office, Kenora). Additional work carried out in the Bad Vermilion Lake area included EM and magnetic surveys on L. Thompson's claims which cover the Stone Occurrence; and a magnetic survey carried out by A. McCormick south of the Smylie Occurrence (Assessment Files, Resident Geologist's Office, Kenora).

Fire River Gold Corporation had a sampling program carried out on its Alice "A" property optioned from J. Redden in the Bennett Lake area (Assessment Files, Resident Geologist's Office, Kenora).

Royal Crest Resources Limited carried out a magnetic survey on 15 claims straddling the western boundary of Bennett Township, including the Red Cedar Occurrence and the Independence Mine (Assessment Files, Resident Geologist's Office, Kenora).

Noranda Exploration Company, Limited, following geological mapping and humus sampling in 1987 on the Mayflower and Hidden Treasure occurrences in the Bennett Lake and Factor Lake areas, conducted stripping on the Hidden Treasure Occurrence in 1988 (Assessment Files, Resident Geologist's Office, Kenora). Other work carried out in the Mine Centre area for gold included stripping by Coldspring Resources Limited in the Little Turtle Lake area; trenching by L. Cousineau in the Little Turtle Lake area; and trenching by D. Kroocmo in the Factor Lake area (Assessment Files, Resident Geologist's Office, Kenora).

PLATINUM GROUP METALS

Four exploration programs were carried out in the Kenora Resident Geologist's District for platinum group metals. Two of these were on the Mulcahy Lake Intrusion, one was on the Entwine Lake Intrusion, and one was in the vicinity of the past–producing Gordon Lake nickel–copper mine 50 km north of Kenora.

American Platinum Incorporated, in the name of R. Holland (Assessment Files, Resident Geologist's Office, Kenora), conducted a ground magnetic survey over its 35 claims which encompass the troctolite layer separating the Lower and Middle Zones of the Mulcahy Lake Intrusion in the Line Lake area southwest of Eagle Lake.

Contwoyto Goldfields Limited, on behalf of 697895 Ontario Limited (Assessment Files, Resident Geologist's Office, Kenora), conducted airborne VLF–EM and magnetic surveys over approximately 140 claims which encompass the majority of the Lower Zone of the Mulcahy Lake Intrusion. Contwoyto Goldfields also conducted stripping, sampling, and geological mapping of a number of separate areas within the claim group. Contwoyto has outlined two platinum group element (PGE) anomalies (up to 238 ppb palladium and 72 ppb platinum) in several units of well–layered, coarse–grained to pegmatitic, sulphide–bearing orthopyroxenite in the Lower Zone of the intrusion. Anomalous chromium values up to 4144 ppm have also been discovered.

BP Resources Canada Limited, on behalf of joint venture partners Southern Era Resources Limited and American Platinum Incorporated, carried out detailed and reconnaissance geological mapping, sampling, and a diamond drilling program on its 617–claim property in the Entwine Lake Intrusion in the Eagle Rock Lake area (G. Campbell, Geologist, BP Resources Canada Limited, personal communication, 1988).

Falcon Point Resources Limited diamond–drilled one short hole at its Norpax Mine property in the Reynar Lake area. No assays were given with the drill log (Assessment Files, Resident Geologist's Office, Kenora).

BASE METALS

During the year there were six active base–metal programs, indicating a resurgence of interest in these commodities.

Minnova Incorporated continued work on its Swell Bay Property in Halkirk Township, carrying out geological mapping and lithogeochemical sampling, completing 17 diamond–drill holes for a total of 5000 m, and carrying out downhole pulse EM surveys on each hole (M. Flanagan, Project Geologist, Minnova Incorporated, personal communication, 1988). The company also diamond–drilled four holes on its Pocket Pond Property in Halkirk Township (Assessment Files, Resident Geologist's Office, Kenora) before returning the option to G. Armstrong (M. Flanagan, personal communication, 1988).

International Platinum Corporation conducted ground magnetic and HLEM surveys, and diamond–drilled one hole (451 feet) on its claims at Eagle Lake in the Buchan Bay area, and Aubrey and Temple townships (Assessment Files, Resident Geologist's Office, Kenora). A drilling program in late 1987 delineated six mineralized zones containing anomalous base–metal and silver mineralization. One of the zones, which contains significant gold–copper mineralization in semi–massive sulphides, is the focus of International Platinum's recent exploration (International Platinum Corporation, Annual Report, 1987).

Rio Algom Exploration Incorporated, in a joint venture with Mill City Gold Incorporated, conducted diamond drilling and ground geophysical surveys over its claims in Bridges Township (R. Schuman, Senior Exploration Geologist, Rio Algom Exploration, personal communication, 1988).

Falconbridge Limited conducted geological mapping, lithogeochemical sampling, and a ground radiometric survey in Watten Township (Assessment Files, Resident Geologist's Office, Kenora). These claims, originally investigated by Kidd Creek Mines Limited, prior to its being taken over by Falconbridge Limited, were staked on the basis of thin, concordant anthophyllite–cordierite zones recognized by Beakhouse (1984).

Noranda Exploration Company, Limited carried out geochemical surveys and sampling programs in the Treelined Lake area and in the Rex Lake area, both for copper–zinc mineralization.

Other work known to have been done in the past year included geological mapping for Walter Cummings on a sulphide showing near the Mather and Potts Township boundary, previously diamond–drilled in 1973 by Canadian Nickel Company Limited.

INDUSTRIAL MINERALS

Dimension Stone

Carter Nelson conducted stripping and sampling on a number of granite properties in the Kenora District, including areas located to the northeast of Kenora at Forgotten Lake, Red Deer Lake, and Wonderland Lake; an area north of the Trans–Canada Highway in Docker Township; and an area close to the Trans–Canada Highway in Revell Township (Assessment Files, Resident Geologist's Office, Kenora).

G. Zebruck, on behalf of Kenora Gold Occurrences Incorporated (Assessment Files, Resident Geologist's Office, Kenora), conducted geological and radiometric surveys on a granite prospect north of Snook Lake.

Decorative Stone

E. Hansen conducted stripping on his large quartz vein in the Line Lake area (Assessment Files, Resident Geologist's Office, Kenora), where his company, Crystal Quarries Limited, is in production.

Graphite

Bellwether Resources Limited conducted an EM survey and a stripping, trenching, and sampling program on a graphite occurrence that trends in a northeasterly direction between Trout Lake and

Treelined Lake in the Treelined Lake area (Assessment Files, Resident Geologist's Office, Kenora).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Current permanent staff in the Resident Geologist's office include C.E. Blackburn, Resident Geologist; M.R. Hailstone, Staff Geologist; C.C. Storey, Drill Core Library Geologist; C.B. Ravnaas, Drill Core Library Geological Assistant; and Marge Guderyan, Secretary. Contract staff during 1988 comprised the following people: J. Parker, Project Geologist in the Dryden–Ignace area, assisted by Mark Perrault; A. Schottroff, who prepared Geological Data Inventory Folios; Joelle Lemay, Clerk–Typist; and A. Anderson, Systems Officer.

In 1988, the exploration properties, and mineral occurrences and prospects listed in Table 2.3 were examined by staff of the Kenora Resident Geologist's office. Companies undertaking exploration are indicated in brackets. Their locations are indicated in Figure 2.2.

M.R. Hailstone continued an assessment of mafic and ultramafic intrusions as hosts for platinum group elements that commenced in 1986. Most of the field work in 1988 was conducted in the Atikwa Lake area.

J. Parker conducted geological mapping at Sunshine Lake, in the Boyer Lake and Meggisi Lake areas, to assess the area for its gold potential. Numerous gold deposits in the general Manitou Lakes–Stormy Lake greenstone belt area were visited. Results of this work were included in a paper presented in December at the Annual Ontario Mines and Minerals Symposium in Toronto, entitled "Gold Mineralization in the Manitou–Stormy Lakes Greenstone Belt, Northwestern Ontario: Nature and Timing", by J.R. Parker, C.E. Blackburn, and M. Perrault (1988). This project was funded by COMDA.

Office staff participated in two geoscience seminars organized by Northwestern Region, Mines and Minerals Division, held in Thunder Bay and Red Lake in February.

At the latter seminar, C.E. Blackburn gave a talk on exploration activity in the Kenora District, and J. Parker presented a paper resulting from field work the previous summer, entitled "The Association of Gold with a Mixed Volcanic Sequence and Eruptive Center at Eagle Lake: Implications for Exploration in the Dryden Area", by J.R. Parker, A. Schottroff, and C.E. Blackburn (1988).

C.E. Blackburn and J. Parker participated as co–authors on a paper entitled "Geological Setting of Gold, Western Wabigoon Subprovince, Canadian Shield: Exploration Targets in Mixed Volcanic Successions", by D.R. Melling, C.E. Blackburn, D.M. Watkinson, and J.R. Parker. The paper has been published by the Canadian Journal of Earth Sciences (Melling *et al.* 1988).

During 1988, 10 Geological Data Inventory Folios were worked on, and 8 were published, bringing the total published to 24 since commencement of the project in 1985. Another 12 were in various stages of preparation at year end. This project is funded by COMDA.

The Kenora Drill Core Library, serving the combined Kenora, Red Lake, and Patricia mining divisions, housed almost 39 000 m of completely catalogued core by November 20, 1988. Almost 24 000 m of core was collected from December 1, 1987 to November 20, 1988.

In addition to specialized field trips for mineral industry and government geologists, trips were provided for Churchill High School of Winnipeg, and for the Dryden High School conservation course. A talk was given to students at J.W. Walker School, Fort Frances, and a display was provided for the Fort Frances District Science Fair.

Office staff attended the annual meeting of the Prospectors and Developers Association of Canada, and the Ontario Mines and Minerals Symposium, both in Toronto, and the Institute on Lake Superior Geology Annual Meeting in Marquette, Michigan.

PROPERTY EXAMINATIONS

GOLD OCCURRENCES AND PROSPECTS

by J. Parker

A number of long–known gold occurrences and prospects were researched and examined as part of the investigations carried out by the Kenora Resident Geologist's Office in the Dryden–Ignace area.

Twentieth Century Mine

The Twentieth Century Mine is located approximately 1.2 km southeast of Jackfish Bay of Upper Manitou Lake, and about 400 m due east of Rector Lake in the Lower Manitou Lake area. The property consists of two shafts and a large dump at the northwestern corner of Mining Location H.P.399.

Stripping and shaft sinking commenced at the mine site between 1899 and 1900 (Carter 1902). The property was acquired by Twentieth Century Mining Company Limited which sank the main shaft to a depth of 389 feet with 470 feet of drifting and 440 feet of crosscutting between 1901 and 1903. A second shaft, 50 feet east of the main shaft, was sunk to a depth of 50 feet. Total production from the mine between 1902 and 1903 was approximately 2492 ounces of gold (total value of $43 586) from 8688 tons of ore milled at an average grade of 0.29 ounce gold per ton (Carter 1904, 1905). The mine has been idle since 1904.

The Twentieth Century Mine is situated within massive and pillowed mafic metavolcanic flows of the Blanchard Lake Group, overlain by calc–alkalic intermediate to felsic pyroclastics and flows of the Upper Manitou Lake Group (Blackburn 1982). The mine is in close proximity to the contact between the two groups. The mine is also situated on the greenschist facies grade side of the greenschist–amphibolite isograd which lies about 800 m west of the mine, parallel to and imposed by, the Atikwa Batholith, which is northwest of Upper Manitou Lake (Blackburn 1976).

According to Carter (1902), lenticular, east–trending, gold–bearing quartz veins, up to 25 feet in width, extend parallel to the regional foliation of the mafic metavolcanics at the mine.

The author observed dominantly massive and pillowed, dark green, mafic metavolcanic flows, intercalated with thin layers of pyritic interflow metasediments, in the vicinity of the two shafts. A massive, east–trending, biotite– and feldspar–phyric granodiorite dike intrudes the metavolcanic rocks, and can be observed at the second shaft. The dike crosscuts the northeast–trending regional foliation of the metavolcanic rocks. The dike is approximately 1.5 m wide, sericitized, weakly carbonatized, and contains one to two percent disseminated pyrite. Quartz veins and veinlets are hosted within fissile mafic metavolcanic rocks in 0.6 m wide shear zones, which extend along the contacts between the dike and the metavolcanics. Fracture–hosted quartz veins also occur within the granodiorite dike. The mafic metavolcanic wall rock is biotitic and contains minor disseminated chalcopyrite and abundant white calcite along narrow hairline fractures. Alteration is confined to the sheared wall rock and is not widespread. Granodiorite and metavolcanic wall rock adjacent to the quartz veins may contain up to five percent disseminated pyrite. The quartz veins consist of milk–white quartz, brown iron carbonate, dark green chlorite, and less than one percent disseminated pyrite with variable amounts of chalcopyrite. Carter (1902) also identified sphalerite in the quartz veins.

A grab sample of pyritic quartz–vein material taken by the author from the dump at the main shaft contained 1630 ppb gold, while a sample of quartz–vein material containing two percent chalcopyrite, taken from the second shaft, analyzed 150 ppb gold. Other samples of wall rock and quartz–vein material, taken in the vicinity of the shafts by the author, analyzed between 9 ppb and 65 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

St. Joe Canada Incorporated (presently Bond Gold Canada Incorporated) has conducted extensive exploration at the Reliance Prospect (Assessment Files, Resident Geologist's Office, Kenora), southeast of the Twentieth Century Mine near Carleton Lake. The Reliance Prospect is geologically similar to the Twentieth Century Mine in that gold–bearing quartz veins are hosted by a strong shear zone in mafic metavolcanic flows of the Blanchard Lake Group. Massive granodiorite dikes intrude the shear zone, which consists of fissile, altered metavolcanic rocks hosting quartz veins which contain pyrite, chalcopyrite, and sphalerite. The major difference is that the shear zone at the Twentieth Century Mine is east–trending, while the shear zone at the Reliance Prospect is northeast–trending.

The shear zones and gold–bearing quartz veins at the Twentieth Century Mine may extend beneath the extensive, swampy overburden situated east, west, and north of the mine. Therefore, potential for discovering an extension of the mineralized zone does exist. Further exploration in the vicinity of the mine for shear zones and felsic or granodiorite dikes, similar to those at the Twentieth Century Mine and Reliance Prospect, may lead to new gold discoveries.

Giant Mine

The Giant Mine (Figure 2.3, Location 3) consists of three shafts, an adit, and numerous trenches and test pits situated on former contiguous Mining Locations H.W.74, H.W.75, and H.W.185 (from west to east), located south of Mosher Bay of Upper Manitou Lake in the Boyer Lake area. A portion of the property is encompassed by claim K.351463, which is presently under lease.

Work commenced at the Giant Mine in 1897 when a pit was sunk to a depth of 24 feet on a quartz vein hosting abundant visible gold (Coleman 1898). A grab sample from the vein taken by Coleman (1898) assayed $6 in gold, at about $17 per ounce of gold.

Development work continued on the property between 1901 and 1904. An adit was driven into a cliff face for a distance of 100 feet on Mining Location H.W.74, and several pits and trenches were sunk over a distance of 300 feet (Carter 1902, 1905; Miller 1903). A shaft, situated above the adit, was sunk to a depth of 60 feet and intersected the adit at 55 feet (Carter 1905). A second shaft was sunk to a depth of 212 feet, with 150 feet of drifting and 24 feet of crosscutting, on Mining Location H.W.75 (Carter 1904). A shaft was also started on Mining Location H.W.185, but was discontinued due to a lack of "pay ore" (Carter 1905).

In 1974, F.V. Regan drilled two holes totalling 62.5 m. Neither hole was drilled near the old workings and no assay results were reported (Assessment Files, Resident Geologist's Office, Kenora).

Cochrane Oil and Gas Limited conducted geological mapping, ground VLF–EM and magnetic surveys, trenching, stripping, sampling, and 2194 feet of diamond drilling in the vicinity of the old workings during 1983 and 1984. Channel samples taken by Cochrane Oil and Gas Limited from two, 0.8 m wide, parallel quartz veins, in an old pit at the extreme eastern end of the property, assayed 0.599

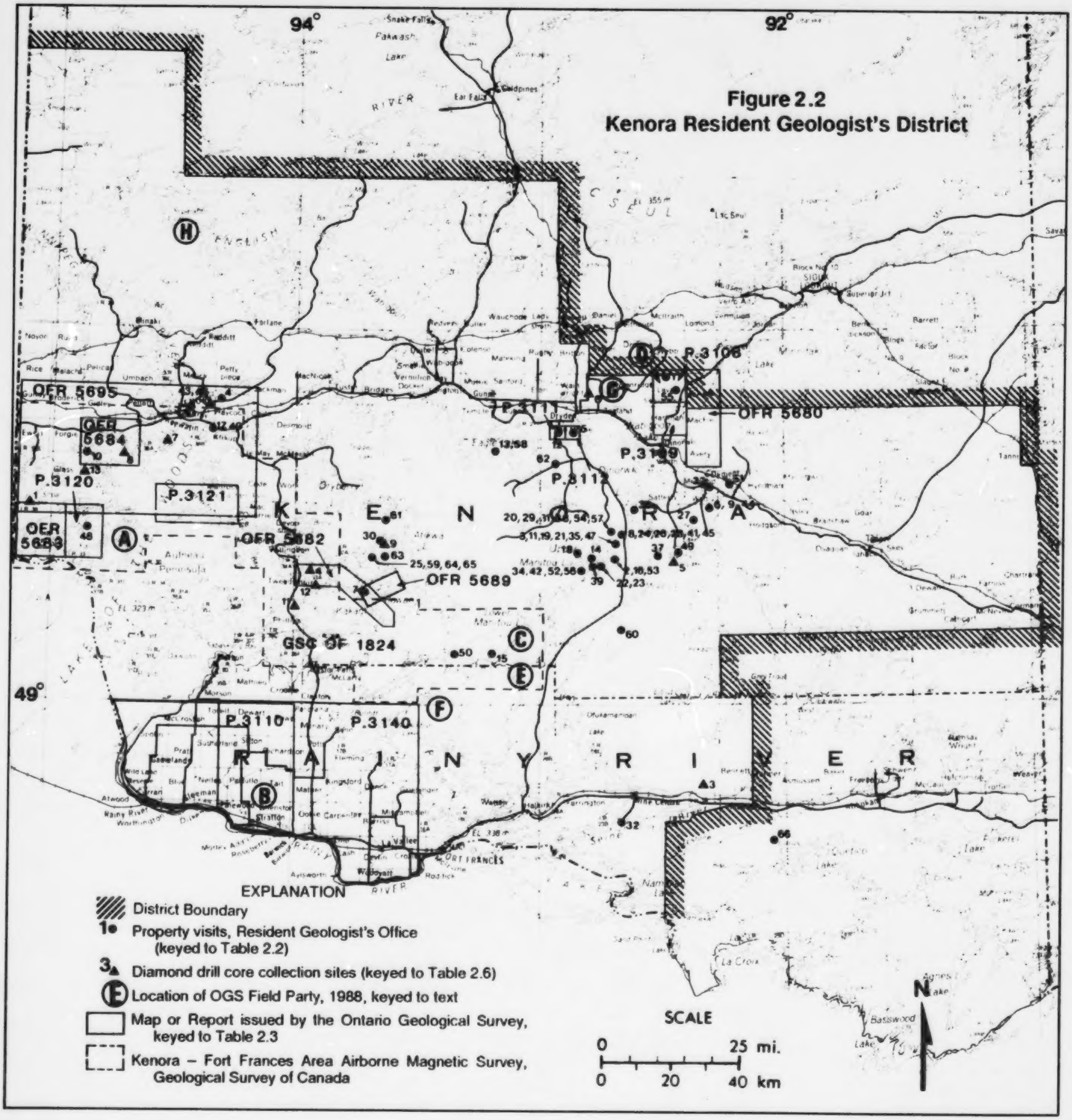


Figure 2.2
Kenora Resident Geologist's District

94°
92°
49°
Pakwash Lake
Ear Falls
RIVER
ENGLISH
SEUL
Lac Seul
Dryden
KENORA
RAINY RIVER
FORT FRANCES
OFR 5695
OFR 5684
OFR 5683
OFR 5682
OFR 5689
OFR 5680
P.3120
P.3121
P.3110
P.3140
P.3106
P.3109
P.3111
GSC OF 1824
Ⓐ
Ⓑ
Ⓒ
Ⓓ
Ⓔ
Ⓕ
Ⓖ
Ⓗ
EXPLANATION
District Boundary
1● Property visits, Resident Geologist's Office (keyed to Table 2.2)
3▲ Diamond drill core collection sites (keyed to Table 2.6)
Ⓔ Location of OGS Field Party, 1988, keyed to text
Map or Report issued by the Ontario Geological Survey, keyed to Table 2.3
Kenora – Fort Frances Area Airborne Magnetic Survey, Geological Survey of Canada
SCALE
0
25 mi.
0
20
40 km
N

TABLE 2.3. PROPERTY VISITS

Gold

1. Beartrack Lake Occurrences, Laval Twp.
2. Big Dick Occurrence, Boyer Lake Area
3. Big Master Mine, Boyer Lake Area
4. Black Sturgeon East Prospect (Kenora Gold Occurrences Incorporated), Haycock Twp.
5. Bonanza Mine and Redeemer Mine, Van Horne Twp.
6. Brockman Prospect (International Platinum Corporation), Tabor Lake Area
7. Cameron Lake Mine Development (Nuinsco Resources Limited–Echo Bay Mines Limited), Rowan Lake Area
8. Canamerica E and F Zones, Boyer Lake Area
9. Church Lake Occurrences (International Platinum Corporation), Kawashegamuk Lake Area
10. Echo Bay Occurrences (Voyager Exploration Limited), Echo Bay Area
11. Elora Mine, Boyer Lake Area
12. Flambeau Lake Prospect (International Platinum Corporation), Aubrey Twp. and Van Horne Twp.
13. Fornieri Bay Prospect (Raleigh Resources Limited), Buchan Bay Area
14. Frenchman Island Occurrences, Harper Lake Area
15. Gates Lake Occurrence, Napanee Lake Area
16. Giant Mine, Boyer Lake Area
17. Gold Cross Occurrence, Kirkup Twp.
18. Gold Rock Mine, Harper Lake Area
19. Gold Rock Mining and Milling Prospect, Boyer Lake Area
20. Goldrock Zone Occurrence, Boyer Lake Area
21. Helena Prospect, Boyer Lake Area
22. H.W. 167 Occurrence, Boyer Lake Area
23. H.W. 170 Occurrence, Lower Manitou Lake Area
24. Imperial or G.19 Occurrence, Boyer Lake Area
25. Krisco Occurrence (Gold–Copper), Atikwa Lake Area
26. Laurentian Mine, Boyer Lake Area
27. Lee Lake Occurrence, Kawashegamuk Lake Area
28. Little Master Prospect, Boyer Lake Area
29. Lunchbox Bay Zone Occurrence, Boyer Lake Area
30. Maybrun Mine (Gold–Copper), Atikwa Lake Area
31. McEdna Prospect and Pincher Creek Zone Occurrence, Boyer Lake Area
32. McKenzie-Gray Occurrence (Nipigon Gold Resources Limited), Bad Vermilion Lake Area
33. New Klondike Occurrence, Melgund Twp.
34. Orion Prospect, Lower Manitou Lake Area
35. Paymaster Prospect, Boyer Lake Area
36. Peak Lake Occurrences, Boyer Lake Area
37. Pelham Prospect and Armstrong Occurrences (Noranda Exploration Company Limited), Boyer Lake Area
38. Peninsula Zone Occurrence, Harper Lake Area
39. Peninsula Prospect, Lower Manitou Lake Area
40. Pine Portage Prospect (President Mines Limited), Kirkup Twp.
41. Quackenbush Occurrence, Boyer Lake Area
42. Reliance Prospect (St. Joe Canada Incorporated), Lower Manitou Lake Area
43. Roseman P.318 Occurrence, Jaffray Twp.
44. Sakoose Mine, Tabor Lake Area
45. Sasakwei Lake Occurrences, Boyer Lake Area
46. Scramble Prospect (Madeleine Mines Limited–Boise Cascade Canada), Jaffray Twp.
47. Selby Lake Prospect, Boyer Lake Area
48. Separation Point Occurrence (BP Resources Canada Limited), Monument Bay Area
49. Snake Bay Prospect, Kawashegamuk Lake Area
50. Straw Lake Beach Mine (Anyox Metals Limited), Bluffpoint Lake Area
51. S.V. 309 Occurrence, Revell Twp.
52. Teck Occurrence, Lower Manitou Lake Area
53. Ten Trench Area Occurrence, Boyer Lake Area
54. Tragalgar Bay Zone Occurrence, Boyer Lake Area
55. Troutfly Lake Occurrence, Laval Twp.
56. Twentieth Century Mine, Lower Manitou Lake Area
57. Victory Prospect, Boyer Lake Area
58. W.W. Smith Prospect (Noranda Exploration Company Limited), Buchan Bay Area

Other Metals

59. Green Bay No. 1 Occurrence (Ni,Cu), Atikwa Lake Area
60. Jock Lake Occurrence (Cu,PGE) (BP Resources Canada Limited, Eagle Rock Lake Area
61. Kenbridge Mine (Ni,Cu), Atikwa Lake Area
62. Nabish Lake Occurrence (Cu,Ni), Contact Bay Area
63. Nilson–Gauthier Occurrence (Ni,Cu), Atikwa Lake Area
64. Northshore Occurrence (Cu), Atikwa Lake Area
65. Ross Creek Occurrence (Ni,Cu), Atikwa Lake Area
66. Samuels Lake Occurrence (PGE), Beaverhouse Lake Area

TABLE 2.4. DRILL CORE COLLECTION SITES

1. Almaden Resources Limited, Snowshoe Bay
2. Calnor Resources Limited, High Lake Property
3. Coloma Resources, Bennett Lake Property
4. Department of Indian and Northern Affairs, Frobisher Occurrence
5. Esso Minerals Canada Limited, Snake Bay Property
6. Geological Survey of Canada, Overburden Drilling near Dryden
7. Gold Hill Resources Limited, Poplar Bay Property
8. Homestake Mineral Development Company, Copper Island Property
9. Madeleine Mines Limited, Maybrun Mine
10. Noranda Exploration Company, Horne–Thrasher Property
11. Pitkanen, T.–Wasabi Resources Limited, Combined Property
12. Proteus Resources Incorporated, Jessie Lake Property
13. Teeshin Resources Limited, Squaw Lake Property (Lake of the Woods)

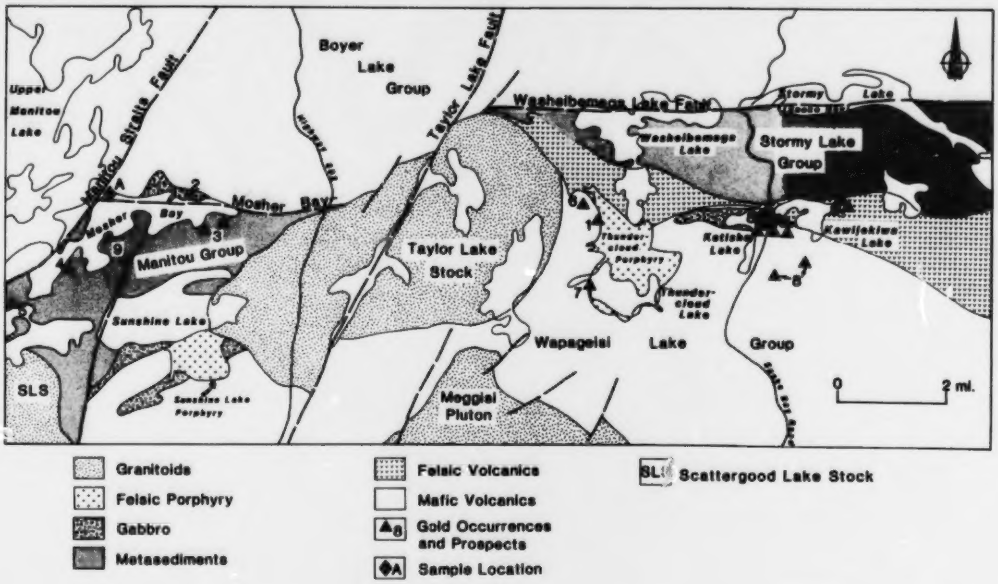

Upper
Manitou
Lake
Manitou Straits Fault
Boyer
Lake
Group
Taylor Lake Fault
Washeibemaga Lake Fault
Stormy
Lake
Washeibemaga
Lake
Stormy Lake
Group
A
2
Mosher Bay
Mosher
Bay
3
9
4
Manitou Group
Taylor Lake
Stock
6
1
Thunder-
cloud
Porphyry
7
Thunder-
cloud
Lake
Katisha
Lake
Kawijekiwa
Lake
8
Sunshine Lake
Sunshine Lake
Porphyry
SLS
Wapageisi
Lake
Group
Moggisi
Pluton
0
2 mi.
Granitoids
Felsic Porphyry
Gabbro
Metasediments
Felsic Volcanics
Mafic Volcanics
8
Gold Occurrences and Prospects
A
Sample Location
SLS
Scattergood Lake Stock

Figure 2.3. *Geology of the Mosher Bay-Stormy Lake Area.*

and 0.508 ounce gold per ton. A channel sample taken across 1 m of wall rock between the two quartz veins assayed 0.017 ounce gold per ton, while a 1 m channel sample of footwall rock assayed 0.019 ounce gold per ton (Assessment Files, Resident Geologist's Office, Kenora).

The Giant Mine is situated within sandstones, siltstones, and polymictic conglomerates of the Manitou Group (*see* Figure 2.3), which have been intruded by felsic, quartz and quartz-feldspar porphyry dikes and sills, and lamprophyre dikes (*see* Gold Studies in the Mosher Bay-Stormy Lake Area, this report). The metasediments overlie alkalic, trachybasaltic flows, and contain thin layers of magnetite iron formation (Blackburn 1981a).

The metavolcanics of the Manitou Group are bounded to the north by the east-trending Mosher Bay-Washeibemaga Lake Fault, which extends along the northern shore of Mosher Bay. The metasediments are also bounded to the west by the Manitou Straits Fault, which extends along the western shore of Mosher Bay (*see* Figure 2.3). Numerous, late, northeast-trending, brittle faults intersect all rock types and structures at Mosher Bay.

The adit, shafts, and test pits at the Giant Mine have been sunk on a wide, strong, east-northeast-trending shear zone, with a strike length in excess of 1 km. Metasediments within the shear zone are fissile, intensely iron carbonatized, and sericitized, and host 0.3 to 0.6 m wide, white to gray-black quartz veins. Intensely sheared and altered quartz-feldspar porphyry dikes also occur within the shear zone. A wide, sheared, porphyry dike was observed by the author at the adit and shaft on former Mining Location H.W.74. The wall rock contains up to one percent fine-grained, disseminated pyrite. Quartz veins on the property consist dominantly of white quartz which may contain brown iron-carbonate, dark green chlorite, hematite, fragments of altered wall rock, and generally less than one percent disseminated pyrite. The quartz vein at the shaft and adit cuts shearing, and appears to be boudinaged along its dip. The quartz veins are also boudinaged and discontinuous along their strike. The author could not locate the 6-foot wide, sulphide-rich quartz vein which Carter (1905) observed at the shaft and adit on Mining Location H.W.74.

Drilling by Cochrane Oil and Gas Limited intersected discontinuous quartz lenses and stringer zones at the contacts between intensely sheared metasediments and quartz-feldspar porphyry dikes beneath the workings of the Giant Mine, and also intersected thin layers of magnetite iron formation hosting quartz veins and stringers (Assessment Files, Resident Geologist's Office, Kenora); however, no gold values were reported. The author noted that although iron formation does occur in the vicinity of the Giant Mine, it does not appear to be associated with gold mineralization.

The author located the two quartz veins where Cochrane Oil and Gas Limited obtained assays of 0.599 and 0.508 ounce gold per ton from channel samples taken from the veins. The veins consist of white quartz with minimal amounts of sulphides. Grab samples taken by the author from the quartz veins and surrounding wall rock contained between 15 ppb and 40 ppb gold. Two grab samples of quartz-vein material, taken by the author from a few of the numerous test pits, returned values of 250 ppb and 935 ppb gold. A grab sample taken from the quartz vein at the adit contained 1300 ppb gold, while a grab sample taken from the pyritic quartz-feldspar porphyry dike at the adit contained 1385 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Other occurrences similar to the Giant Mine occur within the metasediments of the Manitou Group. Both the H.W.167 (*see* Figure 2.3, Location 4) and H.W.170 (*see* Figure 2.3, Location 5) occurrences consist of sheared felsic dikes and metasediments in east-northeast-trending shear zones. Quartz veins are situated at the contacts between the sheared dikes and the metasediments. The dikes also contain fracture-hosted quartz veins. Sulphide content in the wall rocks and quartz veins is generally low; however, the author did obtain a highly anomalous gold value from quartz veins hosted by a felsic dike in the vicinity of the H.W. 167 Occurrence (*see* Gold Studies in the Mosher Bay-Stormy Lake Area, this report).

Exploration should be continued elsewhere along the shear zone at the Giant Mine. The numerous test pits and trenches at the property should be cleaned out and sampled. Exploration within the metasediments of the Manitou Group should be directed to pyritic, altered, and sheared felsic porphyry dikes and sills, as well as quartz veins.

Canamerica E and F Zones

The Canamerica E and F zones, on mining claims K.687434 and K.687437, are located along the southeastern shore of Trafalgar Bay which is the northeastern bay of Upper Manitou Lake.

During the winter of 1985-1986, Cochrane Oil and Gas Limited reported that it had obtained gold assays ranging between 0.08 and 0.532 ounce gold per ton, from sulphide-rich alteration zones hosting quartz-carbonate stockworks at a location on Trafalgar Bay, about 2 km southwest of the former mining town of Goldrock (George Cross News Letter, February 6, 1986). Subsequent trenching and sampling by Canamerica Precious Metals Incorporated, in a joint venture with Cochrane Oil and Gas, delineated a zone averaging 0.12 ounce gold per ton across a true thickness of 24.5 feet. These trenches exposed a mineralized zone for more than 160 feet along strike (The Northern Miner, February 9, 1987).

During the winter of 1986-1987, the company drilled 15 holes totalling 2513 feet at the E and F zones, to follow-up on the promising surface assays (Assessment Files, Resident Geologist's Office, Kenora). One hole, targeted on the E Zone, was reported to have intersected 0.14 ounce gold per ton across 4 m, or 0.111 ounce gold per ton across 1.2 m (George Cross News Letter, April 30, 1987). Drilling at the E Zone delineated a 5 to 8 m wide mineralized zone, over a strike length of about 350 m, with a drill-indicated and inferred tonnage estimated to range between 143 685 t at a grade of 0.167 ounce gold per t, and 529 650 t grading 0.103 ounce gold per t (Assessment Files, Resident Geologist's Office, Kenora). This information differs from estimated tonnages and grades reported in The Northern Miner (July 3, 1987, p.17) which ranged between 163 800 t grading 0.194 ounce gold per t, and 455 000 t grading 0.162 ounce gold per t.

The Canamerica E and F zones are situated within intermediate pyroclastics of the calc-alkalic Upper Manitou Lake Group, near its contact with overlying tholeiitic to calc-alkalic metavolcanic rocks of the Pincher Lake Group. The metavolcanics are intruded by numerous, wide (up to 45 m), northeast-trending, aphanitic felsic dikes. The zones are 1.6 km northwest of the northeast-trending Manitou Straits Fault (Blackburn 1981a, 1982).

The E Zone consists of three test pits, up to 3 m wide, sunk on an intensely sheared, felsic, feldspar-porphyry dike which intrudes sheared, chloritized, and variably carbonatized, intermediate, heterolithic, tuff breccia. The shear zone trends northeasterly and dips steeply southeast. The felsic dike is sericitized, weakly carbonatized, pale gray-green or pinkish-white on fresh surfaces, and weathers white to buff-gray. The dike contains numerous, narrow (less than 4 cm), fracture- and shear-hosted, vertical and flat-lying, quartz-carbonate veins. Wall rock adjacent to the quartz veins is silicified, pyritic, and pink, due to pervasive hematite staining. The felsic dike and quartz veins contain up to three percent, fine-grained, disseminated pyrite. Silicification and associated sulphide mineralization appears to postdate carbonatization and shearing.

Six grab samples taken by the author from the most pyritic and altered portions of the felsic dike, and from the most pyritic quartz veins in the three trenches, returned values of 15, 24, 70, 80, 370, and 565 ppb gold upon analysis (Geoscience Laboratories, Ontario Geological Survey, Toronto). Samples taken from the three test pits by Canamerica Precious Metals assayed between 0.02 ounce gold per ton and 0.437 ounce gold per ton (Assessment Files, Resident Geologist's Office, Kenora).

The F Zone consists of two test pits situated about 180 m west-southwest of the test pits at the E Zone. Test pits at the F Zone have been sunk on an aphanitic, sheared and fractured felsic dike which extends parallel to the dike at the E Zone. The shearing at the F Zone strikes northeasterly and dips vertically. The dike hosts two sets of pyritic quartz veins. The first set is parallel to the northeast-trending shearing and is intersected by a second set of tension-fracture-hosted quartz veins striking northwesterly and dipping southwest. The dike is variably silicified, sericitized, weakly carbonatized, hosts abundant disseminated pyrite, and is pale green on fresh surfaces. Silicified sections of the dike are pinkish-white on fresh surfaces. Portions of the dike exhibit patchy green and purple-red alteration due to abundant, 3 to 6 cm wide haloes of pervasive hematite staining adjacent to hairline fractures.

Grab samples taken by the author from the pyritic, altered felsic dike, and from the pyritic quartz veins, analyzed between 4 ppb and 720 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The F Zone extends southwest onto mining claims K.851368 and K.851369 which are held by M. Woitowicz, a prospector from Dryden. A grab sample taken by the author from the felsic dike on claim K.851368 analyzed 1240 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The author visited an old test pit, where the geological conditions are similar to those at the E and F zones, situated near the eastern shore of Trafalgar Bay across from Leuiller Island. The pit is 800 m southwest of the E and F zones and has been staked by M. Woitowicz. The location of the pit is indicated on geological map 2437 (Blackburn 1981a).

The pit is actually a large open cut which has been sunk on a northeast-trending, salmon pink, aphanitic, carbonatized, sericitized, and silicified felsic dike hosting fracture-hosted quartz veins ranging from 1 to 15 cm in width. The dike and quartz veins contain between two and five percent disseminated pyrite, black tourmaline, and orange-brown iron carbonate. Four grab samples taken by the author from the dike in the open cut returned values of 80, 160, and 350 ppb gold, and 0.105 ounce gold per ton upon analysis and assay (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Geological conditions at the E and F zones, and the open cut, are similar to those of the mineralized zones at the mines near Goldrock. The Elora, Laurentian, and Big Master mines, and the Paymaster, Selby Lake, and Gold Rock prospects have all been developed on wide, northeast-trending, altered felsic dikes hosting shear and fracture-hosted gold-bearing quartz veins. Numerous other gold occurrences and prospects at Upper Manitou Lake are also hosted by felsic dikes. The area south and southwest of the E and F zones, within the Upper Manitou Lake Group, should be thoroughly prospected for more gold-bearing quartz veins hosted by felsic dikes. This area is along strike from the mineralized zones at Goldrock and has the potential for hosting other, as yet undetected, gold deposits.

Big Master (Kenwest) Mine

The Big Master Mine, known as the Kenwest Mine in the late 1940s, consists of two shafts about 1.2 km southeast of the former mining town of Goldrock, at the northeastern end of Trafalgar Bay of Upper Manitou Lake.

The workings at the Big Master Mine are situated on Mining Location H.P.366, held under patent by Kenwest Mines Limited, of which Dickenson Mines Limited has 60 percent ownership. The Big Master and adjacent workings includes patented Mining Locations H.P.373 and H.P.405 situated southwest of the mine, which encompass the Gold Rock Mining and Milling Prospect, and patented Mining Locations H.P.367, 368, and 369, situated northeast of the mine, which encompass the Helena Prospect. All of the Mining Locations are contiguous (Blackburn 1981a).

Exploration commenced in the vicinity of the Big Master Mine in 1895 and shaft sinking began in 1900 (Carter 1901, 1902). The No. 1 shaft was sunk to a total depth of 638 feet with five levels and considerable drifting and crosscutting (Tower 1942, 1946). The mine was the second largest producer in the Goldrock area, with a total recorded production of approximately 2565 ounces of gold from 13470 tons of ore milled, during the intervals 1902 to 1905, and 1942 to 1943 (Mineral Deposit Files, Resident Geologist's Office, Kenora). The mine operated until 1948 but production after 1943 was not reported (Tower 1949).

The Big Master Mine is situated within dominantly mafic metavolcanic flows of the tholeiitic to calc-alkalic Pincher Lake Group, near its contact with the underlying, dominantly calc-alkalic Upper Manitou Lake Group. The mafic flows have been intruded by wide felsic dikes which host the majority of gold-bearing quartz veins in the Goldrock area. The mine is about 800 m northwest of the Manitou Straits Fault (Blackburn 1981a, 1982). The geology of the Goldrock camp has been mapped on two separate occasions at 1 inch to 400 feet, by Thomson (1942), and Blackburn (1981a, Figure 11). Blackburn (1981a) suggested the felsic dikes are shallow-level sills coeval with volcanism, or flows. This author concurs with Thomson (1942) that they are dikes.

Carter (1902) reported that pyritic quartz veins and stringers, hosted by "chloritic schist" and "light coloured highly quartzose schist", contained gold mineralization in the underground workings at the Big Master Mine. Surface work and drilling (Thomson 1942) had outlined four northeast-trending "veins" in the vicinity of the mine. The No. 3 vein was traced on surface for more than 5000 feet, and extends northeast from the No. 1 shaft, through the shaft at the Helena Prospect, and beyond. The No. 4 and No. 5 veins are actually felsite dikes containing quartz stringers and pyrite. The No. 4 vein was traced on surface for a distance of 2400 feet (Thomson 1942).

Canamerica Precious Metals Incorporated recently optioned the patented Mining Locations which encompass the Big Master Mine, Goldrock Prospect, and Helena Prospect, from Kenwest Mines Limited, the present owner. Canamerica's exploration work consisted of reblasting and sampling the numerous old trenches and test pits on these patented claims.

Numerous test pits in the vicinity of the Big Master No. 1 shaft have been sunk on strong, wide (up to 3 m or more), northeast–trending shear zones in chloritic and carbonatized mafic metavolcanic rocks, commonly hosting wide (up to 3 m or more), sheared, fractured, and altered felsic dikes. The felsic dikes and metavolcanic rocks contain numerous fracture– and shear–hosted quartz–carbonate–chlorite veins and stringers. The host rocks contain three to five percent disseminated pyrite and minor chalcopyrite, with fewer sulphides in the quartz veins. The majority of the reblasted trenches are situated along a section of road extending from the old mill to the No. 1 and No. 2 shafts (*see* Blackburn 1981a, Figure 11; Thomson 1942, Map 47K).

Grab samples of altered wall rock and quartz–vein material taken by the author from two test pits 30 to 80 m southwest of the old mill, contained 275 ppb gold, 885 ppb gold, and 0.172 ounce gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto). One test pit, situated on the road adjacent to the old mill, has been sunk on the southwestern extension of the No. 3 vein described by Thomson (1942). The vein consists of quartz, carbonate, tourmaline, and chlorite, with minor disseminated pyrite and chalcopyrite; it occurs along the contact between a felsic dike and mafic metavolcanic rocks.

South and southeast of the Big Master No. 1 shaft, a number of trenches have been sunk on a northeast–trending zone of strong shearing and very intense alteration in feldspar–phyric mafic metavolcanic flows. The mafic flows are iron carbonatized, sericitized, and pervasively silicified; they are pale gray–white on fresh surfaces. The rocks contain abundant fracture–hosted quartz and quartz–carbonate veins and stringers, and abundant disseminated pyrite. Grab samples taken from the trenches by the author assayed 0.05, 0.105, 0.122, and 1.04 ounces gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

A test pit has been reblasted on the northeastern side of the road, northeast of the Big Master No. 2 shaft. The pit has been sunk on the No. 4 vein described by Thomson (1942). The "vein" is a wide, pale gray, intensely sheared and altered felsic dike. The dike hosts a wide quartz vein containing angular, pyritic fragments of wall rock. A grab sample taken by the author from the quartz vein assayed 0.04 ounce gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The author examined numerous trenches which have been reblasted on patented Mining Location H.P.405, also known as the Gold Rock Mining and Milling Prospect, southwest of the Big Master Mine. In addition to numerous test pits and trenches, the Gold Rock Mining and Milling Prospect also consists of four shafts and an adit, which were sunk during 1903 and 1905 (Carter 1904; Corkill 1906). Most of the development was conducted on the No. 4 felsite, a 30 m wide, northeast–trending felsite dike which has been traced on surface for a length of approximately 1000 m (*see* Blackburn 1981a). The dike intrudes sheared and altered feldspar–phyric mafic metavolcanic flows. The felsite is pale brown–pink or pale green; is intensely iron carbonatized, sericitized and silicified; and contains up to five percent fine–grained disseminated pyrite and minor chalcopyrite. The dike hosts a complex network of abundant, narrow (less than 1 cm) quartz veins. Two grab samples taken from the reblasted trenches by the author analyzed 60 ppb and 75 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

A shaft sunk to 56 feet on the No. 5 felsite, located 100 m due west of Selby Lake (*see* Blackburn 1981a), was also examined by the author. The northeast–trending No. 5 felsite is approximately 30 m wide and has been traced on surface for a length of 500 m. This unit is an aphanitic, pink–white, felsic dike containing variable amounts of orange–brown iron carbonate and fine–grained disseminated pyrite. A grab sample taken from the dike, at the shaft, assayed 0.126 ounce gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The author also examined reblasted trenches southwest of the shaft at the Helena Prospect on patented Mining Locations H.P.367 and H.P.368, northeast of the Big Master No. 1 shaft. The shaft at the Helena Prospect was sunk to a depth of 52 feet (Carter 1901, 1902) on the No. 3 vein during 1901. The majority of the trenches and test pits southwest of the Helena shaft have been sunk on the No. 2 and No. 3 veins (*see* Blackburn 1981a, Figure 11).

The majority of these reblasted trenches are in intensely sheared, pale green–brown, carbonatized and pervasively silicified, pillowed mafic metavolcanic flows hosting numerous quartz–carbonate–pyrite veins and veinlets and narrow pinkish–white felsite dikes. The metavolcanic rocks host very fine grained, disseminated pyrite. Two grab samples taken from the altered metavolcanic rocks by the author assayed 0.074 and 0.094 ounce gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto). The combined observations and assay results from the reblasted test pits and trenches situated in the vicinity of the Big Master, Gold Rock, and Helena shafts indicate that significant gold mineralization is hosted by wide northeast–trending felsite dikes and mafic metavolcanic rocks that host quartz veins and pyrite. The dikes make excellent exploration targets due to their large widths and lengths. Alteration is widespread and intense, but localized around the felsic dikes where quartz veining is most abundant.

Examination of these surface exposures, coupled with past mining history, suggests that the Big Master Mine, adjacent prospects, and other past-producing mines at Goldrock still have excellent gold potential.

Lee Lake Occurrence

The Lee Lake Occurrence, about 42 km southeast of Dryden, is located approximately 400 m west of Lee Lake, a small lake about 1 km north of Kawashegamuk Lake.

The Long Lake Gold Mining Company had commenced development work at the Lee Lake Occurrence (also known as the Long Lake–McCracken Occurrence) prior to 1902. Carter (1902) reported that the company had sunk two shafts to depths of 20 and 28 feet on its claim group known as the Long Lake or Santa Marie claims (Long Lake Mine, Assessment Files, Resident Geologist's Office, Kenora) on Mining Locations S.V.353, 354, and 355, and H.W.575. During the early 1930s, the occurrence was restaked (mining claims K.5092 and K.5093). Five quartz veins were located on the property and most of them were reported to contain galena, pyrite, chalcopyrite, and gold.

The occurrence was restaked again, (mining claims K.9164 to K.9175 inclusive) and optioned to Sylvanite Gold Mines Limited who conducted a brief evaluation of the property during 1939. A grab sample taken by Sylvanite Gold Mines Limited from one of the quartz veins on the property assayed $6.40 in gold at $36 per ounce of gold (McCracken Property, Assessment Files, Resident Geologist's Office, Kenora).

In 1964, the Lee Lake Occurrence was held under mining claims K.9904 to 9907 inclusive, by W.L. Olsen (Long Lake Mine, Mineral Deposit Files, Assessment Files, Resident Geologist's Office, Kenora).

In 1983, Labrador Exploration Limited conducted a ground magnetic survey and diamond drilling on 34 claims encompassing the Lee Lake Occurrence, but no drill results were reported (Labrador Exploration Limited, Assessment Files, Resident Geologist's Office, Kenora).

The occurrence was recently staked by A. Glatz, a prospector from Dryden, who has conducted prospecting and sampling on his claims (A. Glatz, personal communication, 1988).

The Lee Lake Occurrence is situated within the Kawashegamuk Lake Group, a mixed sequence of calc–alkalic to tholeiitic, mafic to felsic metavolcanic flows and pyroclastics (Kresz 1987). The metavolcanics are intruded by numerous, felsic, quartz and quartz–feldspar porphyry dikes and plugs, and small gabbro stocks, which commonly host gold–bearing quartz veins. The occurrence is 800 m northeast of the wide, northwest–trending Kawashegamuk Lake shear zone, and occurs at the eastern margin of an extensive area of intense carbonate alteration which extends several kilometres southeast from Dinorwic Lake (*see* Blackburn *et al.* 1987, p.16–20).

The Lee Lake Occurrence consists of two timbered shafts and several shallow test pits and trenches that lie immediately west of a forest access road. These workings are along the contact between a 3 to 9 m wide carbonate vein and a 1.2 to 2.1 wide felsic dike, both of which strike in an easterly direction. The two shafts are incorrectly located about 250 m south of their true location on map P.2569 (Kresz *et al.* 1982).

The carbonate vein and felsic dike have intruded a wide shear zone, which trends in an easterly direction, in pillowed mafic metavolcanic flows. Gold–bearing quartz veins extend along the contact between the dike and carbonate vein. The quartz veins are 15 to 60 cm wide, trend between 250° and 270°, dip to the north, and contain disseminated galena, chalcopyrite, pyrite, and fragments of altered wall rock. The carbonate vein, although poorly exposed, has been traced for approximately 600 m along its strike; it may extend below an area of overburden in the west, and below Lee Lake in the east.

The felsic dike is pale green, intensely sheared and fissile, iron carbonatized, sericitized, and hosts numerous quartz stringers and veinlets. Mafic metavolcanic rocks in the vicinity of the most easterly shaft are intensely altered, weather rusty orange to red brown, and contain narrow quartz veins and veinlets. The carbonate vein weathers red to orange–brown, and hosts disseminated pyrite, chalcopyrite, as well as numerous fracture–hosted quartz stringers and veinlets. X–ray diffraction analysis has shown that the carbonate consists dominantly of pale yellow–brown dolomite and quartz with trace calcite (Geoscience Laboratories, Ontario Geological Survey, Toronto). Two grab samples taken by the author from the carbonate vein contained 26.3 percent CaO, 14.8 percent MgO, 42.8 percent CO_2; and 27.5 percent CaO, 16.5 percent MgO, and 43.5 percent CO_2 (Geoscience Laboratories, Ontario Geological Survey, Toronto). A grab sample taken by the author from the quartz vein at the eastern shaft assayed 0.75 ounce gold per ton, while a grab sample from the quartz vein at the western shaft contained 360 ppb gold. Grab samples taken from the carbonate vein contained between 3 ppb and 20 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Other quartz veins located in the vicinity of the western shaft were sampled by the author. A 15 cm wide quartz vein at the contact between the carbonate vein and the felsic dike, approximately 50 m west of the shaft, analyzed 560 ppb gold. Two grab samples taken from a 15 cm wide quartz vein about

30 m north of the shaft, situated at the contact between an east–trending felsic dike and carbonatized mafic metavolcanic flows, analyzed 140 ppb and 2160 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

An east–trending, altered felsic dike, hosting abundant quartz veins and veinlets, was discovered by A. Glatz close to the northern shore of Lee Lake, about 500 m to the east of the two shafts at the Lee Lake Occurrence. The dike is several metres wide, pale buff–brown, and intensely carbonatized and silicified. Disseminated pyrite, galena, and chalcopyrite occur in the quartz veins and wall rock. Two grab samples taken by the author from the quartz veins contained 710 ppb and 1210 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto). The dike was traced for several hundred metres to the east by the author.

Kresz (1987; Kresz *et al.* 1982) discovered a number of trenches near the southeastern shore of Lee Lake, which have been sunk on another intensely altered felsic dike which hosts quartz veins containing disseminated pyrite and galena. A grab sample taken by Kresz (1987) from one of the quartz veins assayed 0.04 ounce gold per ton and 0.10 ounce silver per ton.

The Lee Lake Occurrence is similar to the gold occurrences at the Snake Bay Prospect near Katisha Lake in the Kawashegamuk Lake area (*see* Gold Studies in the Mosher Bay–Stormy Lake Area, this report). Shear zones at the Snake Bay Prospect occur within mafic metavolcanic rocks and gabbro, and host wide carbonate veins postdated by pervasive silicification associated with gold mineralization. Silicification associated with gold at Lee Lake is confined to discrete quartz veins. Stripping along the strike of the carbonate vein at the Lee Lake Occurrence would assist in the search for more gold–bearing quartz veins, and would help to determine if pervasively silicified gold–bearing zones occur within the vein, similar to the zones at the Snake Bay Prospect.

Gold mineralization at Lee Lake is associated with pyritic, galena–bearing quartz veins in altered and structurally disrupted felsic dikes with long strike lengths. Numerous small, altered, felsic intrusions occur in the vicinity of Lee Lake (Kresz 1987), and should be thoroughly prospected for their gold potential.

RESEARCH BY RESIDENT OFFICE STAFF

GOLD STUDIES IN THE MOSHER BAY–STORMY LAKE AREA

by J. Parker

Introduction

This report summarizes results, from 1988 field work, of an ongoing study of gold mineralization in the Manitou–Stormy lakes metavolcanic–metasedimentary belt (Parker, Blackburn, and Perrault 1988). Field work during the summer of 1988 was concentrated between Mosher Bay of Upper Manitou Lake in the west, and Stormy Lake in the east; it consisted of detailed examinations of known gold occurrences and prospects, reconnaissance sampling, and detailed mapping at a scale of 1:4800 (1 inch = 400 feet) in the vicinity of Sunshine Lake.

The aim of the field work was to assess the economic potential of the belt, and to determine the relationship of gold mineralization to its stratigraphy, structure, and tectonic evolution.

Exploration History

Exploration for gold in the area began around 1897, subsequent to discoveries made at Goldrock on Upper Manitou Lake.

Several shafts and an adit were developed between 1897 and 1905 at the Giant Mine (*see* Figure 2.3, Location 3) (Carter 1904; Blackburn 1981a), south of Mosher Bay, and some limited work was conducted at the Big Dick Prospect (*see* Figure 2.3, Location 2) on the northeastern shore of Mosher Bay in 1897 and 1933 (Coleman 1898; Thomson 1934). Channel sampling at the Giant Mine, conducted by Cochrane Oil and Gas Limited during 1983 and 1984, resulted in assays as high as 0.599 and 0.508 ounce gold per ton across two, 0.8 m wide, parallel quartz veins, and 0.019 ounce gold per ton across 1 m of sheared wall rock (Cochrane Oil and Gas Limited, Assessment Files, Resident Geologist's Office, Kenora).

The Pelham Prospect (*see* Figure 2.3, Location 6), southwest of Washeibemaga Lake, was discovered in 1937, where exploration continued intermittently between 1938 and 1974 (Blackburn 1981a). Many encouraging gold values have been obtained from chip samples taken across several of the mineralized zones at the Pelham Prospect, such as 0.125 ounce gold per ton across 8 feet, 0.43 ounce gold per ton across 3.5 feet, and 0.46 ounce gold per ton across 14 feet, with grab samples assaying over 5.0 ounces gold per ton (Osisko Lake Mines Limited, Assessment Files, Resident Geologist's Office, Kenora).

Esso Minerals Canada, in a joint venture with Teck Explorations Limited, and Noranda Exploration Company, Limited in a joint venture with Tundra Gold Mines Limited, are the most recent companies to conduct exploration programs at the Pelham Prospect. A drilling program conducted by Noranda Exploration on its portion of the prospect resulted in drill intersections such as 0.16 ounce gold per ton across 3 m and 0.12 ounce gold per ton across 2 m (Tundra Gold Mines Limited, News Release, March 21, 1988).

Noranda Exploration has also recently conducted exploration programs on the Armstrong and Renders occurrences (*see* Figure 2.3, Locations 1 and 7, respectively) south of the Pelham Prospect. Chip samples taken across the mineralized zones at the Armstrong Occurrence have given assay values ranging between 0.08 ounce gold per ton across 3 feet, and 0.32 ounce gold per ton across 3.2 feet (Fornieri Option, Assessment Files, Resident Geologist's Office, Kenora). Samples taken from trenches at the Renders Occurrence gave consistent gold and silver values as high as 5743 ppb gold and 31.5 ppm silver (Renders, P., Assessment Files, Resident Geologist's Office, Kenora).

Esso Minerals Canada has been exploring for gold between Katisha and Stormy lakes, where it has discovered 13 separate mineralized zones since 1983 (*see* Figure 2.3, Location 8). Channel samples taken from the zones have assayed between 2 and 10 g gold per ton over variable widths (Esso Minerals Canada, Assessment Files, Resident Geologist's Office, Kenora). Diamond drilling has indicated that gold occurs within numerous discontinuous and narrow zones assaying as high as 0.14 ounce gold per ton across 0.84 m, 0.26 ounce gold per ton across 0.15 m, and 0.5 ounce gold per ton across 0.54 m (George Cross News Letter, September 13, 1986).

Derry, Michener, and Booth Limited flew an airborne EM survey over the Stormy Lake area during 1970 (Derry, Michener, and Booth Limited, Assessment Files, Resident Geologist's Office, Kenora).

Sulpetro Minerals Limited conducted ground magnetic and EM surveys at Gawiewiagwa, Kawijekiwa, Katisha, and Seggemak lakes during 1982 (Sulpetro Minerals Limited, Assessment Files, Resident Geologist's Office, Kenora).

Voyager Explorations Limited conducted gold exploration near Gawiewiagwa Lake during 1983 and 1985. Gold assays from grab and channel samples were generally low or anomalous (Voyager Explorations Limited, Assessment Files, Resident Geologist's Office, Kenora).

Jalna Resources Limited conducted an extensive reconnaissance survey of the Manitou–Stormy lakes belt during 1983. No significant gold mineralization was reported, although anomalous gold values were obtained during extensive lithogeochemical sampling (Jalna Resources Limited, Assessment Files, Resident Geologist's Office, Kenora).

Labrador Exploration Limited conducted geological mapping and sampling during 1984 on a small group of claims southeast of Kawijekiwa Lake. No significant gold values were reported (Labrador Exploration Limited, Assessment Files, Resident Geologist's Office, Kenora).

General Geology

The Manitou–Stormy lakes belt is an assemblage of metavolcanic and metasedimentary rocks which trends in an easterly direction, and extends for approximately 80 km from Lower Manitou Lake in the west, to Bending Lake in the east.

Blackburn (1982) has outlined the stratigraphy of the belt, which is comprised of tholeiitic mafic flows and calc–alkalic (Kresz 1984) intermediate to felsic pyroclastics of the basal Wapageisi Lake Group, unconformably overlain by intercalated metavolcanic and metasedimentary rocks of the Manitou and Stormy Lake groups (*see* Figure 2.3). The metasediments are comprised of sandstones, argillites, and polymictic and volcaniclastic conglomerates. Alkalic trachybasaltic flows occur at the base of the metasediments in the Manitou Group, but have not been identified in the Stormy Lake Group. The Boyer Lake Group, to the north, is in contact with the Manitou and Stormy Lake groups along the east-trending Mosher Bay–Washeibemaga Lake Fault, and consists of a monotonous sequence of pillowed mafic flows (*see* Figure 2.3).

The metavolcanic–metasedimentary assemblage has been intruded by the granitoid Taylor Lake and Scattergood Lake stocks (Blackburn 1981a). The Taylor Lake Stock (*see* Figure 2.3) has been dated at 2695 Ma (Davis *et al.* 1982), and was emplaced late in the tectonic development of the belt. The Wapageisi Lake Group has also been intruded by the Meggisi Pluton (*see* Figure 2.3), which is situated south of the Manitou–Stormy lakes belt, and is part of the much larger Irene–Eltrut lakes batholithic complex (Blackburn 1981b).

Intermediate to felsic pyroclastics and epiclastics at the top of the Wapageisi Lake Group, in the Mosher Bay–Stormy Lake area, have been intruded by subvolcanic felsic quartz–porphyry stocks (*see* Figure 2.3). The Thundercloud Porphyry at Washeibemaga and Thundercloud lakes has been interpreted by Blackburn (1981a) to be the source of porphyritic felsic metavolcanics in the immediate area. The Sunshine Lake Porphyry intrudes mafic flows at the top of the Wapageisi Lake Group and may also be subvolcanic (Blackburn 1981a). A minimum age of 2755±2 Ma has been obtained from the Thundercloud Porphyry (Davis *et al.* 1982), while a preliminary age of 2752 Ma has recently been obtained from the Sunshine Lake Porphyry (D.W. Davis, Royal Ontario Museum, personal communication, 1988). These dates indicate that the two porphyries were emplaced at about the same time, and that the Wapageisi Lake Group is older than 2755 Ma.

The top of the Wapageisi Lake Group is also intruded by a series of syenitic to monzonitic dikes, biotite–phyric lamprophyre dikes, composite gabbro sills, and felsic porphyritic dikes. Pyroxene– and biotite–phyric lamprophyre dikes and sills intrude the Sunshine Lake Porphyry and the metasediments and metavolcanic rocks of the Manitou Group. The lamprophyre dikes are in turn intruded by the Taylor Lake Stock. Lamprophyre dikes have not been recognized in the metasediments of the Stormy Lake Group.

Structural Geology

Various episodes of shear zone and fault development have occurred in the Mosher Bay–Stormy Lake area. Early northwest–trending shear zones and north–trending faults occur within the Wapageisi Lake Group (*see* Figure 2.4), at Katisha and Kawijekiwa lakes. These structures terminate at the unconformity between the Wapageisi and Stormy Lake groups, indicating that they were developed prior to the deposition of the Stormy Lake Group.

East– and east–northeast–trending shear zones in the Manitou Group developed later, probably during movements along the Mosher Bay–Washeibemaga Lake Fault (*see* Figure 2.3). Blackburn (1982) interpreted the fault to be a thrust fault, along which the Boyer Lake Group was thrust over the Manitou and Stormy Lake groups.

The northeast–trending Manitou Straits Fault, a major deformation zone extending through the Manitou–Stormy lakes belt for approximately 80 km (Blackburn 1981b), passes through the southwestern corner of Mosher Bay, and is associated with intense, northeast–trending shearing (*see* Figure 2.3).

Numerous late, northeast–trending, brittle faults intersect all rock types and structures. The most prominent of these is the Taylor Lake Fault (*see* Figure 2.3), along which a sinistral displacement of at least 2 km has been estimated (Blackburn 1981a).

Characteristics of Gold Mineralization

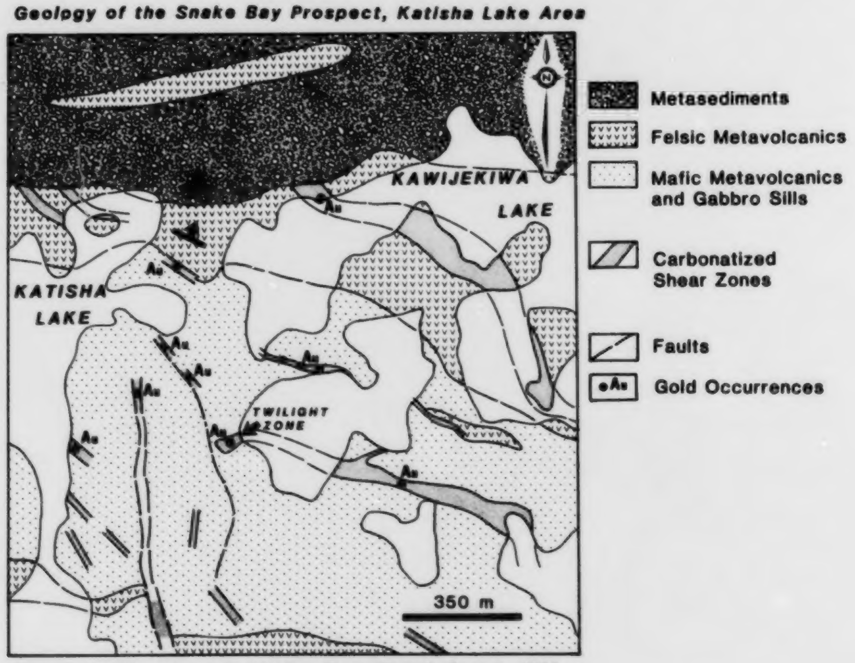
Gold is concentrated in three specific areas within the Mosher Bay–Stormy Lake area. Gold mineralization in each area is associated with different styles of alteration and structural disruption and occurs with different types of sulphide mineralization and host rocks.

MOSHER BAY

The known gold occurrences and prospects near Mosher Bay consist of the Giant Mine Ten Trench area, Big Dick Occurrence, H.W.167 Occurrence, and the H.W.170 Occurrence (*see* Figure 2.3, Locations 3, 9, 2, 4, and 5 respectively).

All of the gold occurrences and prospects, with the exception of the Big Dick Occurrence, are hosted by sandstones, argillites, and polymictic conglomerates of the Manitou Group. The Giant Mine, H.W.167, and H.W.170 occurrences are situated within east–northeast–trending shear zones occupied by sheared, porphyritic, felsic dikes. The metasediments and felsic dikes within the shear zones are fissile, sericitized, iron carbonatized, and commonly contain less than two percent disseminated pyrite.

Quartz veins are hosted in shear zones and (or) northwest–trending tension fractures, and rarely


Geology of the Snake Bay Prospect, Katisha Lake Area
N
KAWIJEKIWA
LAKE
KATISHA
LAKE
TWILIGHT ZONE
Au
350 m
▨ Metasediments
▨ Felsic Metavolcanics
☐ Mafic Metavolcanics and Gabbro Sills
▨ Carbonatized Shear Zones
☐ Faults
●Au Gold Occurrences

Geology Modified after E.P. Moreton, Esso Minerals Canada, 1986

Figure 2.4. *Geology of the Snake Bay Prospect.*

contain more than one percent pyrite. At the occurrence southwest of Mosher Bay, named the Ten Trench area by Jalna Resources Limited (Jalna Resources Limited, Assessment Files, Resident Geologist's Office, Kenora), the sandstone host rocks are not sheared but contain abundant 1 to 5 cm wide, tension fracture–hosted quartz veinlets which strike north–northeasterly.

The Big Dick Occurrence on the northern shore of Mosher Bay consists of a strong, narrow, northeast–trending shear zone, which extends along the contact between gabbro and a coarse–grained, quartz–feldspar porphyry dike. The gabbro is fissile, intensely iron–carbonatized, pyritic and chloritized. Quartz veins are shear zone– and tension fracture–hosted, and contain altered fragments of wall rock, disseminated pyrite, arsenopyrite, and minor chalcopyrite.

During the present study, all the occurrences and prospects described above were sampled. Most of the samples analyzed yielded anomalous gold values. The best result was from a sheared felsic dike in the vicinity of the H.W.167 Occurrence, which analyzed 1495 ppb gold. A grab sample of pyritic sandstone taken from a pit at the Ten Trench area analyzed 1470 ppb gold. A grab sample of pyritic quartz–vein material, taken from the adit at the Giant Mine, had 1300 ppb gold; and a sample from a pyritic, quartz–feldspar porphyry dike at the adit analyzed 1385 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Amygdaloidal, massive and pillowed mafic flows at the northwestern corner of Mosher Bay, indicated on Ontario Geological Survey Map 2437 (Blackburn 1981a), were also sampled. Two grab samples taken from sheared, carbonatized, pyritic, and variably silicified, mafic flows along the lake shore returned values of 85 ppb gold and 1640 ppb gold (*see* Figure 2.3, Sample Location A) (Geoscience Laboratories, Ontario Geological Survey, Toronto). The area where the two samples were taken is near former mining location H.W.208, referred to as the Queen of the Lakes Mine in an undated Manitoba Free Press mining supplement (Mineral Deposit Files, Resident Geologist's Office, Kenora).

KATISHA LAKE

The Snake Bay Prospect (*see* Figure 2.3, Location 8; Figure 2.4), near Katisha Lake, consists of 13 separate gold–bearing zones discovered by Esso Minerals Canada. Gold mineralization is confined to the upper part of the Wapageisi Lake Group, near the unconformity with the overlying Stormy Lake Group. The most significant mineralized zones are hosted by numerous, 1 to 15 m wide, north–trending faults, and northwest–trending shear zones in a magnetite–bearing, composite gabbro sill and magnetite–bearing, mafic metavolcanic flows. The shear zones have been sericitized, and pervasively and intensely iron carbonatized, and host colloform–textured carbonate veins up to 5 m in width.

The carbonate veins contain angular xenoliths of wall rock and minor disseminated pyrite. The carbonate alteration is postdated by pervasive silicification and quartz veining, associated with abundant disseminated pyrite, arsenopyrite, and gold. The silicified zones are narrow, pod–shaped, and concentrated in flexures and wider sections of the shear zones. A second phase of silicification, consisting of barren quartz veins, overprints the earlier gold–bearing phase of silicification. Alteration terminates abruptly at the boundaries of the shear zones.

All of the mineralized zones at the Snake Bay Prospect were sampled during the present study, with assay and analysis values ranging from 5 ppb gold to 0.5 ounce gold per ton and with arsenic as high as 10.5 percent (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Biotite–phyric lamprophyre dikes are hosted by three of the mineralized shear zones, and several of the east–trending shear zones, in the vicinity of Katisha Lake. A vesicular lamprophyre dike intersects a silicified, gold–bearing shear zone at the Twilight Zone (*see* Figure 2.4). Although some of the lamprophyre dikes are sheared and carbonatized, it is clear that they were emplaced late in the structural development of the shear zones, and that they postdate mineralization.

WASHEIBEMAGA–THUNDERCLOUD LAKES

The known gold occurrences and prospects at Washeibemaga and Thundercloud lakes are the Pelham Prospect which consists of 12 mineralized zones, the Armstrong Occurrence, and the Renders, or Patterson, Occurrence (*see* Figure 2.3, Locations 6, 1, and 7 respectively). All of the known gold mineralization occurs adjacent to the Thundercloud Porphyry, at the top of the Wapageisi Lake Group.

The geology of the Pelham Prospect, southwest of Washeibemaga Lake, has been described by Blackburn (1981a) as a complex succession of mafic flows and pyroclastics alternating with lenses of felsic flows, ash flows, coarse pyroclastic rocks, and very minor epiclastics. The gold–bearing zones are hosted by coarse, heterolithic pyroclastics, and coarse–grained magnetite–bearing mafic rocks, which Blackburn (1981a) interpreted as metavolcanic flows, but which Moreton (Geologist, Esso Minerals Canada, personal communication, 1986) interpreted as a gabbro sill.

The gold–bearing zones have variable widths and lengths, and strike in almost every direction. The zones are characterized by intense fracturing which is cut by several narrow shear zones. Alteration consists of patchy, intense biotitization, silicification, and epidotization, with associated variable amounts of disseminated pyrrhotite, pyrite, chalcopyrite, and gold. Biotite also occurs in small clots (less than 5 mm in size) clustered within alteration haloes surrounding hairline fractures. Epidote generally occurs within well-defined fractures or joints, and numerous, variably oriented fractures which have produced complex, net-vein fracture systems bearing a close resemblance to those attributed to hydrofracturing.

Hobbs (1987) has stated that the hydrofracturing process is initiated when the pore pressure of the host rock is increased, until cracking occurs along grain boundaries to form open fractures. At the Pelham Prospect, the intense hydrofracturing has produced mineralized zones of variable sizes with irregular, variable, and poorly defined lengths, widths, and trends.

The fractured, mineralized zones are cut by narrow shear zones which have disrupted previously altered and mineralized rocks. The shearing at the No. 7 zone hosts boudinaged and drag-folded epidote veins, stretched biotite clots, and sulphide mineralization which is "smeared-out" along shear planes. A shear zone which intersects the No. 3 zone is pervasively silicified and cuts epidote veins. These observations indicate that shearing and some silicification postdated alteration and gold mineralization. Observations made under the microscope on thin sections, show that alteration zones have been overprinted by abundant fibrous chlorite and actinolite, indicating that alteration was postdated by metamorphism. Unaltered actinolite- to chlorite-rich rocks weather dark green, while the altered, biotite-rich rocks weather buff-white. The weathering imparts a chaotic, patchy, white and green appearance to the altered rocks.

Grab samples from the No. 3 zone at the Pelham Prospect, taken during the present study, contained between 17 ppb gold and 0.102 ounce gold per ton. A grab sample from the silicified shear zone, which cuts the No. 3 zone, returned a value of 935 ppb gold. A 4 foot chip sample across the No. 7 zone assayed 0.26 ounce gold per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Gold mineralization at the Armstrong Occurrence (*see* Figure 2.3, Location 1) occurs within patchy alteration zones in a coarse, poorly sorted, heterolithic tuff breccia and in very large blocks of pillowed mafic flows within the breccia. The heterolithic tuff breccia is situated between mafic metavolcanic flows to the west and a pyroclastic phase of the Thundercloud Porphyry to the east. The tuff-breccia consists of 90 percent subangular clasts, composed of mafic and intermediate metavolcanic and intrusive igneous rocks, and felsic rocks of the Thundercloud Porphyry, in a mafic to intermediate matrix. Alteration is the same as at the Pelham Prospect (*see* Figure 2.3, Location 6), and consists of patchy biotitization, silicification, and epidotization, with associated disseminated pyrite and pyrrhotite.

The alteration is overprinted by abundant dark green chlorite and actinolite. Chlorite occurs along hairline fractures, rims the clasts in the tuff breccia, and appears to have replaced portions of the clasts. Intense epidote veining occurs in net-vein fracture systems which have resulted from hydrofracturing. Brecciation due to hydrofracturing also occurs within the Thundercloud Porphyry. Hydrofracturing is the only obvious structural disruption at the Armstrong Occurrence.

A grab sample of the altered, pyritic tuff breccia, taken during this study, returned a value of 1870 ppb gold, while grab samples from the altered mafic flows gave 520 ppb gold and 725 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The Renders, or Patterson, Occurrence (*see* Figure 2.3, Location 7), which is also situated at the margin of the Thundercloud Porphyry, was not visited during this study.

Discussion

Gold mineralization within the upper part of the Wapageisi Lake Group, at Katisha and Washeibemaga-Thundercloud lakes (*see* Figure 2.3), is spatially and temporally associated with a major tectonic zone that was the focus for shear zone development and intrusive hydrothermal activity. The stratigraphic succession within the Wapageisi Lake Group suggests that there was an evolution from quiescent, deep water, mafic, tholeiitic, submarine flows with little or no clastic sedimentation, to more violent, felsic, calc-alkalic pyroclastic volcanism, some of which was subaerial.

The overlying Stormy Lake Group, consisting of clastic metasediments associated with felsic volcanic rocks, situated above a well-defined unconformity, is of proximal alluvial fan facies, to fluvial facies, which grades both laterally and upward into distal submarine fan facies.

The thick, mafic flow sequences of the Wapageisi Group probably formed during rifting of an early, undetermined basement (Blackburn 1980). Blackburn (1980) suggested a model whereby subsequent, calc-alkalic volcanism resulted from subduction of the early mafic flows. Subvolcanic, felsic intrusions, such as the Sunshine Lake and Thundercloud porphyries (*see* Figure 2.3), were emplaced at this time. Amphibolite-grade metamorphism was imposed by the intrusion of a late phase of the Meggisi pluton (*see* Figure 2.3, Blackburn 1981b) in basaltic rocks adjacent to its margin, at the end of basaltic volcanism (Blackburn 1982). The lower basaltic units of the Wapageisi Lake Group were affected by this metamorphic event.

The north-trending faults and northwest-trending shear zones associated with gold mineralization at Katisha Lake are confined to the upper part of the Wapageisi Lake Group. The shear zones and faults terminate at the unconformity between the

Wapageisi Lake Group and metasediments of the Stormy Lake Group, indicating that the structures were developed prior to the deposition of the metasediments (*see* Figure 2.4). These shear zones and faults may have been formed as subvertical conjugate structures during uplift and relative downwarping, related to calc–alkalic volcanism and the emplacement of subvolcanic intrusions.

The shear zones were conduits for hydrothermal fluids responsible for massive carbonate veining and alteration. Later silicification, accompanied by arsenopyrite, pyrite, and gold mineralization, overprinted the carbonatized shear zones. The abundant magnetite content of the mafic rocks, which host the majority of the shear zones, was a contributing factor in gold concentration. Magnetite was replaced by sulphides, during sulphidation, which initiated gold deposition from the mineralizing fluids. Hydrothermal fluids generated by widespread amphibolitization of basaltic rocks, at the margin of the Meggisi Pluton (*see* Figure 2.3), may have been the source of gold mineralization.

None of the structures, intense carbonate alteration, and silicification associated with gold mineralization in the Wapageisi Lake Group, extend into, or occur within, the overlying metasediments. Localized, intensive carbonate–chlorite–magnetite alteration occurs within the metasediments of the Stormy Lake Group but is not associated with structures, carbonate veining, or gold mineralization. Recent zircon uranium–lead geochronology by D.W. Davis (Royal Ontario Museum, personal communication, 1988) has indicated that there is an approximate 50 Ma age difference between the Wapageisi Lake Group and the Stormy Lake and Manitou groups. As stated above, the Thundercloud and Sunshine Lake porphyries which intrude the Wapageisi Lake Group have been dated at 2755±2 Ma at a minimum (Davis *et al.* 1982) and 2752 Ma as a preliminary age (D.W. Davis, Royal Ontario Museum, personal communication, 1988), respectively. These dates indicate that the Wapageisi Lake Group is older than 2755 Ma. However, preliminary dates on rhyolitic metavolcanic flows near the base of the Stormy Lake and Manitou groups have been recently obtained by D.W. Davis (Royal Ontario Museum, personal communication, 1988) of 2703 Ma and 2699 Ma, respectively. These ages imply that overlying rocks which may have been affected by the deformation and alteration associated with gold mineralization in the Wapageisi Lake Group, were removed from the stratigraphic succession during a 50 Ma hiatus, followed by the deposition of the Manitou and Stormy Lake groups.

Lamprophyre dikes were intruded late in the development of the shear zones and postdate gold mineralization. It has recently been proposed that calc–alkalic lamprophyres in Archean shields throughout the world may have been sources for gold mineralization since they are commonly known to be significantly enriched in gold (Rock *et al.* 1987; Rock and Groves 1988). However, all known lamprophyres in the vicinity of Katisha Lake were sampled during the present study, and proved to contain less than 8 ppb gold, with the exception of the dike which intersects gold mineralization at the Twilight Zone (*see* Figure 2.4), which returned a value of 38 ppb gold upon analysis (Geoscience Laboratories, Ontario Geological Survey, Toronto). The lack of significant gold enrichment in the dikes suggests that they were not a direct source of gold: however, gold mineralization and lamprophyres may have been generated in a common tectonic setting (Wyman and Kerrich 1988a, 1988b).

Gold deposits in the Washeibemaga–Thundercloud lakes area are spatially and temporally associated with the Thundercloud Porphyry (*see* Figure 2.3), and are unlike any other gold occurrences in the Manitou–Stormy lakes belt. Gold at the Pelham Prospect and Armstrong Occurrence (*see* Figure 2.3, Locations 6, 1) is accompanied by biotitization, silicification, and epidotization, with associated sulphides, which are controlled by intense hydrofracturing in metavolcanic rocks. Carbonatization is not associated with gold, unlike the occurrences at Mosher Bay and Katisha Lake. Gold mineralizing processes were probably different from those which operated elsewhere in the belt.

Gold mineralization at the Pelham Prospect and Armstrong Occurrence may have been deposited by hydrothermal fluids associated with the Thundercloud Porphyry. Localized hydrofracturing in the porphyry, and in metavolcanic rocks immediately adjacent to the porphyry, occurred during devolatilization or the release of magmatic fluids which deposited gold. The gold mineralizing event would have occurred at about 2755 Ma, the age date obtained from the Thundercloud Porphyry (Davis *et al.* 1982).

Shearing and metamorphic overprinting of the mineralized zones at the Pelham Prospect occurred during the emplacement of the Taylor Lake Stock (*see* Figure 2.3) dated at 2695±4 Ma (Davis *et al.* 1982).

Late movement along the east–trending Mosher Bay–Washeibemaga Lake Fault (Figure 2.3), accompanied by the intrusion of late felsic dikes and gold mineralization, may have been synchronous with the final stages of tectonism. Movement along the fault produced the east– and east–northeast–trending, carbonatized, and sericitized shear zones which host gold mineralization in the metasediments of the Manitou Group at Mosher Bay (*see* Figure 2.3).

It is apparent that gold was deposited in rocks of the Manitou–Stormy lakes belt during two separate periods in the evolution of the belt. Parker, Schottroff, and Blackburn (1988) have described similar age differences in gold mineralizing events at the Fornieri Bay and W.W. Smith gold prospects on

Eagle Lake, southwest of Dryden. Gold deposits at Fornieri Bay, and in the Eagle Lake area in general, are commonly associated with structurally controlled quartz veins, and have characteristics typical of Archean lode gold deposits.

However, at the W.W. Smith Prospect on Hardrock Bay, there is evidence that gold was deposited synvolcanically amongst mafic flows, proximal to a volcanic vent. The W.W. Smith Prospect is situated at the top of a lower mafic sequence, in close proximity to an eruptive center, at the transition into overlying intermediate to felsic calc–alkalic metavolcanic rocks (*see* Blackburn *et al.* 1988, p.30–35). This geological environment is very similar to that in the Mosher Bay–Stormy Lake area.

Gold at Fornieri Bay may have been deposited by metamorphic hydrothermal fluids generated during the emplacement of the nearby Atikwa Batholith dated at 2732±1 Ma (Davis *et al.* 1982). The gold-bearing mafic flows at Hardrock Bay are overlain by dacitic flows which have been dated at 2743±1 Ma (Davis *et al.* 1982), which provides an upper age limit for both the mafic flows and the gold.

Conclusions

Gold in the Manitou–Stormy lakes belt occurs in a variety of geological environments, associated with different controls and alteration, which indicates that mineralizing hydrothermal fluids of different compositions deposited gold during two distinct periods in the evolution of the metavolcanic host rocks.

At Washeibemaga and Thundercloud lakes, and Katisha Lake (*see* Figure 2.3), gold was deposited in synvolcanic structures within the upper part of the Wapageisi Lake Group during, or shortly after, calc–alkalic volcanism and before the deposition of the overlying Stormy Lake Group. Magmatic and metamorphic hydrothermal fluids may have been sources for gold mineralization.

Gold occurrences at Mosher Bay, in the metasediments of the Manitou Group (*see* Figure 2.3), are typical Archean lode gold deposits formed during the final stages of emplacement of granitoid batholiths around the Manitou–Stormy lakes belt.

This situation is comparable to that in the Hardrock Bay–Fornieri Bay area at Eagle Lake, where gold was deposited both synvolcanically near a volcanic vent in mafic flows at the top of a lower mafic sequence, and in structurally controlled gold–bearing quartz veins deposited in calc–alkalic felsic pyroclastic rocks, by metamorphic hydrothermal fluids, during the emplacement of nearby granitic plutons (Parker, Schottroff, and Blackburn 1988).

This study further supports the observation made by Parker, Schottroff, and Blackburn (1988) that there is a spatial and temporal relationship between gold and stratigraphy in the combined Eagle–Wabigoon and Manitou–Stormy lakes greenstone belts. Gold mineralization and volcanic centers are situated at the transition from lower mafic metavolcanic sequences into overlying middle or upper sequences of calc–alkalic, or mixed tholeiitic to calc–alkalic, composition. Fewer gold deposits are situated within the monotonous sequences of dominantly tholeiitic, mafic metavolcanic flows (*see* Figure 2.5), an observation also made by Melling *et al.* (1988), for the larger Dryden–Sioux Narrows region. The association between gold, eruptive centers, and mixed metavolcanic sequences suggests that gold may be closely related to the volcanic processes and tectonic environments of calc–alkalic metavolcanic rocks, at the transition from basaltic to felsic volcanism. There may have been original synvolcanic gold enrichment and later concentration of gold, due to late metamorphic hydrothermal processes, into nearby structures.

These observations suggest that the deposition of gold mineralization in the Manitou–Stormy lakes and Eagle–Wabigoon lakes greenstone belts, did not occur during an isolated event, but resulted from a dynamic, complex system of related geological processes which evolved over a considerable period of time.

Recommendations for Exploration

Exploration for carbonatized, silicified, gold–bearing shear zones should be continued below the unconformity between the Wapageisi Lake Group and the Stormy Lake Group, east of Katisha Lake, in the vicinity of Stormy Lake (*see* Figure 2.3). Outcrop exposure is poor, but the area has good potential for further discovery of gold. More gold occurrences may also be found around the margins of the Thundercloud Porphyry (*see* Figure 2.3), although outcrop exposure in this area is also poor.

Exploration should be conducted around the margins of the Sunshine Lake Porphyry which may host gold occurrences similar to the Pelham Prospect and Armstrong Occurrence (*see* Figure 2.3, Locations 6 and 1). Limited detailed mapping was conducted during the present study over a portion of the Sunshine Lake Porphyry. Gold mineralization was not detected, but epidote veining was observed in the mafic metavolcanic and intrusive rocks adjacent to the porphyry.

Exploration at Mosher Bay should be concentrated in the metasedimentary rocks, but also in the mafic metavolcanic rocks along the northwestern shore of Mosher Bay, where the author obtained highly anomalous gold assays from silicified and pyritic mafic metavolcanic flows (*see* Figure 2.3, Sample Location A).

In general, the upper part of all lower mafic sequences in the Eagle–Manitou lakes greenstone belt provide an extensive target for gold exploration. More significant gold occurrences may be found in the vicinity of known eruptive centers, at the transition from basaltic to calc–alkalic volcanism.

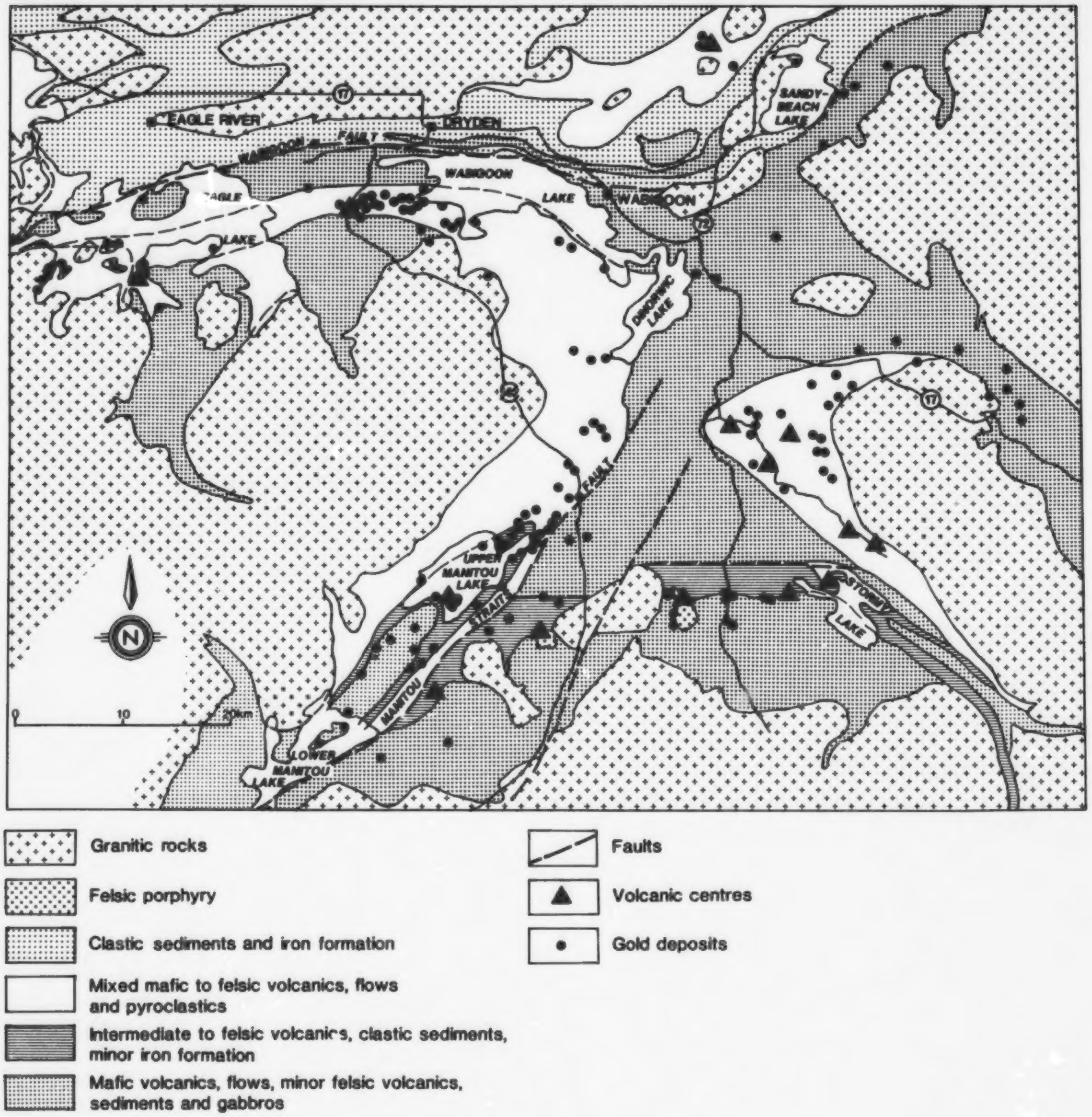

EAGLE RIVER
17
DRYDEN
WABIGOON
FAULT
WABIGOON
LAKE
WABIGOON
72
EAGLE
LAKE
SANDY-
BEACH
LAKE
DINORWIC
LAKE
17
FAULT
UPPER
MANITOU
LAKE
STRAITS
MANITOU
LOWER
MANITOU
LAKE
STORMY
LAKE
N
0
10
20km
Granitic rocks
Felsic porphyry
Clastic sediments and iron formation
Mixed mafic to felsic volcanics, flows and pyroclastics
Intermediate to felsic volcanics, clastic sediments, minor iron formation
Mafic volcanics, flows, minor felsic volcanics, sediments and gabbros
Faults
Volcanic centres
Gold deposits

Figure 2.5. *Location of Gold Deposits in the Eagle–Manitou Lake Greenstone Belt.*

PGE POTENTIAL OF ULTRAMAFIC–MAFIC INTRUSIONS

by M.R. Hailstone

Introduction

A compilation of data pertaining to platinum group elements (PGE), results of sampling done in 1986 and 1987, and suggestions for other potential targets in the Kenora Resident Geologist's District were presented in Blackburn *et al.* (1987, p.22–24; 1988, p.22–30). In a continuation of this program, further geological work and sampling was done by the author in three areas in 1988, namely the Atikwa Lake area, the Eagle Rock Lake area, and the Factor Lake–Beaverhouse Lake areas in Thunder Bay Mining Division.

Results of the 1988 work are reported below, with results of work done in 1987, but previously unreported, at Hay Island and Pipestone Peninsula in the Bigstone Bay and Whitefish Bay areas, and at Caliper Lake in Claxton Township.

In the Atikwa Lake area, copper–nickel and copper–gold deposits occur in, or adjacent to, four mafic to ultramafic intrusions (*see* Figure 2.6): the Denmark Lake Intrusion, the Overflow Bay Intrusion, the Rupert Lake Intrusion, and the Empire Lake Intrusion. In the Eagle Rock Lake area, copper deposits occur within the Entwine Lake Intrusion. In the Factor Lake–Beaverhouse Lake area, a number of mafic to intermediate intrusions occur. These include the Samuels Lake Intrusion, whose economic potential is unknown at the present time. Copper and gold deposits occur in, or adjacent to, the differentiated, ultramafic to mafic, Pipestone Peninsula sills at Hay Island and Pipestone Peninsula. In Claxton Township, the Caliper Lake Intrusion has received little attention in the search for base and precious metals.

Denmark Lake Intrusion

The Denmark Lake Intrusion, in the Atikwa Lake area, is polyphase and consists of peridotite, gabbro, diorite, quartz diorite and granodiorite, emplaced in that order (Davies 1973). Low water levels in 1988, and fresh rock cuts on the Maybrun Road, facilitated observation of outcrops: the intrusion can be best described as a large, polyphase, intrusion breccia containing fragments ranging in size from centimetres to tens of metres.

The largest exposure of peridotite is located 0.5 km south of the western end of Denmark Lake. The surface weathers dark brown to a more purplish brown with an increase in magnetite content. It is commonly coarse grained and may be highly magnetic due to disseminated magnetite and 0.5 to 1 cm wide "cracks" filled with magnetite. According to Davies (1973), olivine occurs in 1 to 2 mm grains which have been partially altered to serpentine and magnetite, and local poikilitic clinopyroxene is partially altered to massive amphibole. Copper–nickel occurrences in the Denmark Lake Intrusion are closely associated with these peridotites and their host gabbros.

At the eastern end of Denmark Lake, a large circular magnetic anomaly identified in airborne geophysical surveys (Ontario Geological Survey 1987) suggests a large peridotite body under the lake. Drilling in this area by Falconbridge Nickel Mines Limited, in 1957, encountered serpentinized peridotite and hematite staining but no sulphide mineralization.

The grey to brownish grey, medium-grained gabbro that makes up the bulk of the Denmark Lake Intrusion is commonly brecciated and stoped by later diorite and granodiorite intrusions. Common mineral assemblages in the gabbro (Davies 1973) are massive amphibole after clinopyroxene, talc, and magnetite as alteration products of orthopyroxene, plagioclase altered to sericite, and epidote with chlorite along fractures, and local, primary, brown amphibole and olivine with magnetite and apatite as accessories.

Mineralization in the Denmark Lake Intrusion occurs as late magmatic blebs and net-textured sulphides (pyrrhotite, pyrite ± chalcopyrite ± pentlandite) associated with stoped ultramafic blocks in the gabbros. The Ross Creek copper–nickel occurrence, the Nilson–Gauthier copper–nickel occurrence, and the Green Bay No. 1 copper–nickel occurrence are representative of this type. In addition, gold occurs in a pyritiferous quartz vein in sheared granodiorite at the Krisko gold–copper occurrence.

Also discussed here is the North Shore copper occurrence, where sulphides (pyrrhotite, pyrite ± chalcopyrite) are present in mafic metavolcanics, near the Denmark Lake Intrusion.

ROSS CREEK COPPER–NICKEL OCCURRENCE

The Ross Creek Occurrence (*see* Figure 2.6, Location D) is on the western shore of the Lawrence River, 0.5 km southwest of Caribou Lodge. The occurrence is hosted by pyroxenite within a grey gabbro which contains xenoliths of mafic volcanic rock. Granodiorite intrudes all these rocks.

The property was last explored by Green Bay Mining and Exploration in 1956, which conducted diamond drilling in 11 holes, a self potential survey, a geological survey, and excavated five trenches (Assessment Files, Resident Geologist's Office, Kenora).

Trench No. 1 has exposed a steep rock face at the river's edge, and has the best mineralization. Blebs of pyrrhotite and chalcopyrite up to 1 cm in size, and up to seven percent by volume, are dispersed across a 1 m wide area in the pyroxenite. The showing is small, with little lateral extent visible on surface, but mineralization may extend under the Lawrence River.

Diamond drilling was done in the vicinity of Trench No. 11. The best intersection in drill core was 4 feet of 0.35 percent copper and 0.27 percent nickel in hole No. 10. Hole No. 11, which was drilled under hole No. 10, intersected 1.2 feet of 25 percent pyrrhotite and chalcopyrite. A dimethyl glyoxime test was positive, but no assays for nickel were reported. A review of the drill logs and sections suggested that there may be two zones of pyroxenite with an easterly trend and a northerly dip.

Three trenches were sunk 210 m southwest of trench No. 11 and 30 m west of the Lawrence River, and another trench was sunk 360 m southwest of trench No. 11 and 180 m west of the Lawrence River. Sulphides in these trenches are pyrrhotite and pyrite, with only a trace of chalcopyrite. Samples 19, 20, 21 (*see* Table 2.5) are from trench No. 11; Sample 22 is from a coarse-grained magnetic pyroxenite on the eastern side of the river; and Samples 23 and 24 are from the trenches southwest of No. 11. Northeast-trending shears, along the shoreline of the Lawrence River, that are coincident with a northeast-trending linear on Ontario Geological Survey Map 2273 (Davies 1973), may be an in-

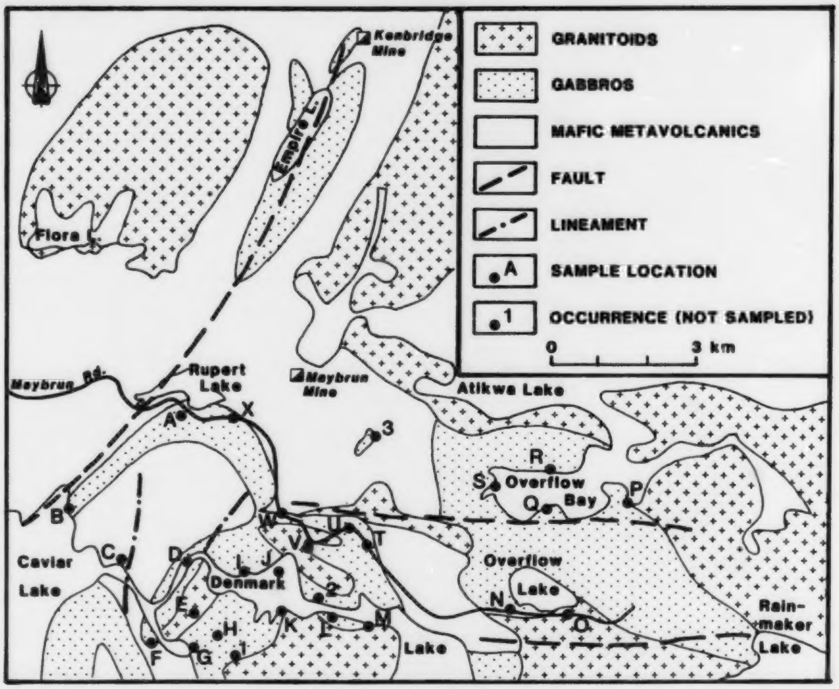


Figure 2.6. *Sample Sites and Geology, Atikwa Lake Area.*

dication of a zone of weakness into which dioritic to granodioritic magma was emplaced.

NILSON-GAUTHIER COPPER-NICKEL OCCURRENCE

The Nilson-Gauthier Occurrence is located on the northern shore of Denmark Lake, 350 m east of the rapids at the northwestern corner of the lake (*see* Figure 2.6, Location I). This copper-nickel occurrence is hosted by a coarse-grained, magnetite-bearing pyroxenite, containing blebs of pyrrhotite and chalcopyrite up to 1 cm in diameter, and up to ten percent by volume. The showing is exposed in a 15 m long trench sunk on an east-trending shear. Magnetite occurs locally as east-trending 1 cm wide seams. Sulphides (pyrite ± chalcopyrite) occur as patches and blebs, and as net textured disseminations.

In 1986, C.C. Huston and Associates carried out an IP survey and diamond-drilled nine holes to test resultant anomalies (Assessment Files, Resident Geologist's Office, Kenora). Five north-trending anomalies were delineated by the IP survey. Anomaly No. 1 was tested with three holes, each of which encountered sheared and serpentinized mafic and ultramafic rocks, with only trace amounts of chalcopyrite, pyrite, and pyrrhotite. Neither the shear nor the sulphide minerals encountered were interpreted to be the cause of the anomaly, which remained unexplained by the survey company.

Anomaly No. 2 was tested with two holes, the first of which encountered 3.4 feet of serpentinized peridotite containing 0.78 percent nickel and 0.67 percent copper. This interval is contained within a gabbro-peridotite interval of 41.9 feet that contains 0.19 percent nickel and 0.27 percent copper. The second hole, drilled below the first, encountered 36.1 feet of mainly gabbro and peridotite, with minor basalt, containing 0.23 percent nickel and 0.26 percent copper. The similarity of the nickel and copper values, and rock types encountered, suggest a westerly dip to the zones.

Analytical results from samples taken by the author from the trench and dump are presented in Table 2.5, Samples 32 to 35.

GREEN BAY NO. 1 COPPER-NICKEL OCCURRENCE

The Green Bay No. 1 occurrence is exposed in a 15 m trench trending 140° (*see* Figure 2.6, Location F). Gabbro in the trench is medium- to coarse-grained, contains mafic volcanic xenoliths, and is cut by 2 to 5 cm wide pegmatitic diorite dikes. Coarse sulphides are found within these dikes. Up to five percent sulphides are present: as coarse blebs of pyrrhotite and chalcopyrite, the latter commonly rimming the former; and as pyrite stringers. In 1956, four holes were diamond-drilled in a fan under this trench by Green Bay Mining and Exploration Company; the best intersection being 1.5 feet containing 0.31 percent copper and 0.19 percent nickel (As-

TABLE 2.5. TRACE ELEMENT GEOCHEMICAL ANALYSES FROM SELECTED MAFIC AND ULTRAMAFIC INTRUSIONS.

Sample No.	Location (Fig 1.6)	Intrusion or Other Association	Au ppb ppm*	Pt ppb	Pd ppb	Ni ppm	Cu ppm	Cr ppm	Co ppm	TiO_2 %
1	A	Rupert Lake	6	2	3	72	840	140	74	0.86
2	A	Rupert Lake	5	<1	<1	260	120	238	58	0.44
3	A	Rupert Lake	4	<1	<1	190	228	199	47	0.40
4	B	Rupert Lake	3	1	<1	188	165	286	56	0.53
5	B	Rupert Lake	<2	<1	<1	234	67	258	48	0.40
6	B	Rupert Lake	<2	1	1	226	56	236	44	0.39
7	B	Rupert Lake	<2	4	3	124	68	640	44	0.46
8	B	Rupert Lake	<2	<1	<1	40	187	32	54	0.98
9	B	Rupert Lake	<2	<1	<1	20	33	76	20	
10	C	Mafic Volcanics	545	<1	<1	42	2220	172	50	0.97
11	C	Mafic Volcanics	<2	1	<1	42	126	172	36	
12	C	Mafic Volcanics	<2				30			
13	C	Mafic Volcanics	100				2250			
14	C	Mafic Volcanics	27	<1	<1	36	875	140	64	0.96
15	C	Mafic Volcanics	<2				153			
16	C	Mafic Volcanics	3	<1	<1	86	112	272	38	0.78
17	C	Mafic Volcanics	<2				34			
18	C	Mafic Volcanics	<2				272			
19	D	Denmark Lake	70	41	42	1290	3520	890	92	0.33
20	D	Denmark Lake	28	63	55	1630	3560	880	114	0.35
21	D	Denmark Lake	7	16	30	600	314	710	98	0.19
22	D	Denmark Lake	<2	4	2	1180	99	2040	114	0.15
23	D	Denmark Lake	4	<1	<1	84	116	42	54	1.64
24	D	Denmark Lake	22	48	48	970	815	446	100	0.37
25	E	Denmark Lake	14.74*	<1	<1	22	1750	282	22	0.13
26	F	Denmark Lake	<2	1	2	208	410	352	54	0.40
27	G	Denmark Lake	3	3	3	114	74	344	38	0.55
28	H	Denmark Lake	<2	8	2	1120	12	1270	112	0.20
29	H	Denmark Lake	<2	<1	<1	870	68	840	108	0.18
30	H	Denmark Lake	<2	9	8	1170	61	1190	120	0.17
31	H	Denmark Lake	<2	2	1	1200	105	1150	140	0.18
32	I	Denmark Lake	3	4	3	308	158	660	52	0.24
33	I	Denmark Lake	<2	5	3	590	159	1260	110	0.15
34	I	Denmark Lake	3	18	7	530	203	900	68	0.44
35	I	Denmark Lake	29	180	71	1180	6200	1180	100	0.42
36	J	Denmark Lake	<2	1	<1	1360	31	910	146	0.20
37	K	Denmark Lake	7	2	1	308	285	594	62	0.97
38	K	Denmark Lake	3	<1	<1	74	158	162	24	
39	L	Denmark Lake	<2	1	<1	710	88	790	94	0.35
40	M	Denmark Lake	<2	<1	<1					
41	M	Denmark Lake	<2	<1	<1	550	52	94	104	0.24
42	N	Overflow Bay	<2	5	7	448	44	1200	62	0.39
43	O	Overflow Bay	<2	<1	<1	<5	124	30	46	1.68
44	P	Overflow Bay	3	7	6	350	225	1000	62	0.35
45	Q	Overflow Bay	<2	4	2	560	55	1670	82	0.18
46	Q	Overflow Bay	17	8	7	660	1040	1510	86	0.21
47	Q	Overflow Bay	2	<1	<1	280	120	650	54	0.20
48	R	Overflow Bay	<2	<1	<1	234	62	600	60	0.80
49	R	Overflow Bay	40	86	71	2100	3030	650	172	0.10
50	S	Overflow Bay	2	<1	<1	70	174	150	40	
51	S	Overflow Bay	<2	1	3	540	72	1200	84	0.22
52	S	Overflow Bay	22	<1	<1	70	176	124	40	1.37
53	T	Denmark Lake	310	<1	<1		19	68		
54	U	Denmark Lake	<2	1	<1	570	17	72	108	0.17
55	V	Denmark Lake	<2	<1	<1	30	122	168	24	
56	W	Denmark Lake	16	<1	<1	65	220	125	50	0.91
57	X	Rupert Lake	<2	1	<1	38	164	86	52	0.82
58		Mafic Volcanics	4430	<1	<1	48	243	206	46	
59		Mafic Volcanics	25.8*	<1	<1	60	4560	142	198	
60		Mafic Volcanics	29	<1	<1	32	42	254	14	
61		Mafic Volcanics	860	<1	<1	32	490	174	62	
62		Mafic Volcanics	4	<1	<1	830	26	1130	94	
63		Pipestone Peninsula	<2	<1	1	670	<5	1180	98	
64		Pipestone Peninsula	<2	<1	<1	910	14	960	100	
65		Pipestone Peninsula	4	<1	1	208	6	1420	36	
66		Pipestone Peninsula	<2	9	5	880	20	1890	116	
67		Pipestone Peninsula	<2	<1	<1	32	5	161	6	
68		Pipestone Peninsula	<2	<1	<1	154	27	348	34	
69		Pipestone Peninsula	<2	<1	<1	306	34	520	66	
70		Pipestone Peninsula	<2	<1	<1	160	135	42	32	
71		Pipestone Peninsula	<2	1	1	104	112	210	44	
72		Pipestone Peninsula	<2	<1	<1	40	34	150	12	
73		Pipestone Peninsula	<2	<1	<1	26	37	126	12	
74		Samuels Lake	4	<1	17	540	197	560	95	
75		Samuels Lake	4	20	20	370	115	1075	103	
76		Samuels Lake	2	3	2	47	136	151	56	
77		Samuels Lake	200	1515	2450	545	2350	1410	86	
78		Samuels Lake	2	<1	33	143	310	252	60	
79		Samuels Lake	<2	6	3	63	248	162	68	
80		Samuels Lake	<2	21	18	75	132	810	31	
81		Samuels Lake	3	15	18	108	144	395	73	
82		Samuels Lake	9	3	3	61	144	154	62	
83		Samuels Lake	3	4	4	95	148	414	66	
84		Samuels Lake	5	6	4	420	560	645	110	
85		Caliper Lake	<2	<1	<1					
86		Caliper Lake	2	7	4					
87		Caliper Lake	<2	<1	1					
88		Caliper Lake	<2	<1	<1					
89		Caliper Lake	2	1	2	268	10	850		
90		Caliper Lake	<2	<1	18					
91		Caliper Lake	<2	<1	<1					
92		Caliper Lake	<2	<1	<1					
93		Caliper Lake	<2	3	3					
94		Caliper Lake	<2	<1	<1	52	40	148	26	
95		Caliper Lake	<2	<1	<1	300	30	706	36	

sessment Files, Resident Geologist's Office, Kenora). Analytical results from a sample taken by the author are given in Table 2.5, Sample 26.

KRISKO GOLD–COPPER OCCURRENCE

The Krisko Occurrence, called the Caviar Lake Occurrence by Davies (1973), is located 400 m east of the outflow of the Lawrence River into East Bay of Caviar Lake (*see* Figure 2.6, Location E) and is hosted by xenolithic granodiorite that intrudes gabbro of the Denmark Lake Intrusion. A 0.3 m quartz vein has been exposed for 100 m in a trench, and a 6 m deep shaft. The vein is of the "crack and seal" type, and pinches and swells slightly both along strike and in vertical section. The vein was emplaced in a shear that trends 013°. Between three and five percent pyrite and chalcopyrite occur as patches and along vertical fractures.

Alteration consists of sericite and carbonate within the shear and in fractures in the vein. The shear appears to occupy a zone within the granodiorite that is particularly xenolith rich; outcrops of massive granodiorite 25 m on either side of the shear have a lower content of xenoliths. In 1956, E. Krisko diamond–drilled two short holes on a north–trending quartz vein east of the main vein (Assessment Files, Resident Geologist's Office, Kenora). Electromagnetic, magnetic, and geological surveys were conducted in 1986 (Martin, R., Assessment Files, Resident Geologist's Office, Kenora).

Analytical results from a composite grab sample taken along the trench north and south of the shaft, to test for the possibility of PGE transported by hydrothermal solutions, are given in Table 2.5 (Sample 25).

NORTH SHORE COPPER OCCURRENCE

The North Shore Occurrence is hosted within amphibolitized pillowed lavas approximately 1 km west of the Denmark Lake Intrusion (*see* Figure 2.6, Location C), along a shear that trends 155° on the northern side of East Bay, and 180° on the southern side of East Bay. Sulphides (pyrite, pyrrhotite ± chalcopyrite) occur in vesicles, late fractures, and in pillow selvages. The metavolcanics are cut by at least one quartz–porphyry dike that is 1 m wide, and strikes 60°.

In 1956, Green Bay Mining and Exploration excavated five trenches, conducted geological and self potential surveys, and diamond–drilled two holes (Assessment Files, Resident Geologist's Office, Kenora). The logs indicate that both drillholes intersected a large proportion of granitic material and quartz porphyry. No assays are reported, but chalcopyrite hosted by metavolcanics was encountered in one of the holes.

Because this occurrence is located within 1 km of the Denmark Lake Intrusion, is associated with a north–trending shear, and shows evidence of hydrothermal activity in the form of minor quartz–carbonate filled fractures that may contain chalcopyrite, samples were collected to test for the possibility of PGEs transported by hydrothermal solutions. Analytical results are given in Table 2.5, Samples 10 through 18.

MISCELLANEOUS SULPHIDE OCCURRENCES

Other sulphide showings within the Denmark Lake Intrusion that were sampled, are similarly associated with coarse–grained, magnetic, pyroxenite bodies, tens of metres in diameter (*see* Figure 2.6, Locations G, H, J, K, L, M, T, U, V, and W). Analytical results are given in Table 2.5, Samples 27 through 31, 36 through 41, and 53 through 56.

Not visited by the author, but reported by J.M. Moore (Kenora Nickel Mines Limited, Assessment Files, Resident Geologist's Office, Kenora), are a number of other sulphide showings. One of these (*see* Figure 2.6, Location 2), on the northern shore of Denmark Lake, a small, 1 m^2 area, contains up to 15 percent disseminated sulphides as blebs of pyrrhotite, chalcopyrite, and pentlandite, hosted by dark green pyroxenite. Sulphides are reported in east–trending joint planes up to 60 m east of this showing.

At a second occurrence (*see* Figure 2.6, Location 1), 1 km south of the western end of Denmark Lake, "dark nigh mafic gabbro", carrying finely disseminated chalcopyrite and iron sulphides, gave a strong dimethyl glyoxime test for nickel. The gabbro cuts black, fine–grained, basaltic metavolcanics. Stringers are commonly less than 3 cm wide, but some irregular masses of gabbro are up to 1 m across. The showing is located on the eastern side of a 50 to 100 m wide swamp, along the northwestern side of a hill. Sulphide associated with small dikes of solid magnetite has reportedly been traced along 600 feet of the edge of the hill; the best mineralized area has been trenched. This showing is of particular interest because it is within the main body of peridotite south of the western end of Denmark Lake.

Overflow Bay Intrusion

The Overflow Bay Intrusion, like the Denmark Lake Intrusion, can be best described as polyphase and dominated by intrusion breccia, in which a grey, medium–grained gabbro is cut into blocks by dioritic to granodioritic rock. Peridotitic to pyroxenitic ultramafic rock is the host to copper–nickel occurrences and showings. Unlike the Denmark Lake Intrusion, sulphides appear to be associated with a patchy, pale green alteration, possibly of chlorite and serpentine, that envelopes subangular fragments of unaltered magnetic pyroxenite up to 2 m in size.

In addition to occurrences within the intrusion, the Apex Turtle Lake copper–nickel occurrence will be discussed. It is hosted in a small gabbro body intruded into mafic metavolcanics 1 km west of the Overflow Bay Intrusion.

OVERFLOW BAY OCCURRENCES

A pyrrhotite–chalcopyrite occurrence on the tip of a prominent point of land on the southern shore of Overflow Bay is exposed in three trenches (*see* Figure 2.6, Location Q). Noranda Mines Limited carried out a magnetic survey over the occurrence in 1952 and diamond–drilled two inclined holes to the northwest to test a strong east–trending anomaly just offshore from the showing. Both holes intersected "dark magnetic gabbro" throughout, containing traces of pyrrhotite and chalcopyrite (Assessment Files, Resident Geologist's Office, Kenora). Analytical results from a sample taken at this occurrence are given in Table 2.5, Sample 46.

Approximately 20 m south of this showing, on the shore of the eastern side of the point, the author observed a breccia zone containing fragments of coarse–grained magnetic pyroxenite and medium–grained grey gabbro, in a gabbro to diorite matrix. West of the point, an outcrop of northwest–trending, coarse–grained, magnetic pyroxenite was noted along the shoreline. Noranda Mines' magnetic survey defined both the breccia zone and the magnetic pyroxenite to the west as magnetic highs. Analytical results from samples taken in this vicinity are given in Table 2.5, Samples 45 through 47.

On the northern shore of Overflow Bay, approximately 800 m north of the previously mentioned showing, a 1 m^2 amoeboid–shaped patch of sulphide is hosted by coarse–grained magnetic pyroxenite (*see* Figure 2.6, Location R). On an airborne gradiometer survey (Geological Survey of Canada 1982), a magnetic anomaly was indicated over this showing. This example and the anomalies noted over the previously mentioned occurrences suggest that further coarse–grained pyroxenite and additional mineralization may be found by magnetic surveys and additional prospecting. Analytical results from samples taken at this locality are given in Table 2.5, Samples 48 and 49.

The previously mentioned patchy alteration that typifies occurrences in this intrusion is well exposed on two islands in Overflow Bay (*see* Figure 2.6, Locations P and S). Analytical results from samples taken in these vicinities are given in Table 2.5, Samples 44 and 50 through 52. Additional sampling of sulphides hosted by coarse–grained magnetic pyroxenite along the southern margin of the Overflow Bay Intrusion, and exposed on the Maybrun road (*see* Figure 2.6, Locations N and O), are given in Table 2.5, Samples 42 and 43.

APEX TURTLE LAKE COPPER–NICKEL OCCURRENCE

The Apex Turtle Lake Occurrence (*see* Figure 2.4, Location 3) was not visited: the following description is derived from published and unpublished reports. The occurrence is hosted by a pod–shaped mafic intrusion, in mafic metavolcanics, striking 60°, that according to Thompson *et al.* (1957), appears to bottom at 600 feet. Spotty disseminated chalcopyrite and pyrrhotite are found throughout the intrusion and in minor amounts in the volcanics. At surface, mineralization, which occurs over a length of 500 feet, is exposed in several trenches (Thompson *et al.* 1957).

Apex Consolidated Resources Limited conducted magnetic surveys and diamond–drilled 45 holes during 1955 and 1956 (Assessment Files, Resident Geologist's Office, Kenora). According to Thompson *et al.* (1957), the best drill intersections were 1.08 percent copper and 0.62 percent nickel over 25 feet, and 0.51 percent copper and 0.98 percent nickel over 12 feet. Davies (1973) has suggested that part of the mineralization is associated with an east–trending fault that was intersected in two adjacent diamond–drill holes, and that these intersections may represent a single lens of mineralization with an average true width thickness of 12 feet containing 1.03 percent copper and 0.56 percent nickel.

Rupert Lake Intrusion

The Rupert Lake Intrusion is a crescent–shaped body composed of medium–grained gabbro, amphibole–phyric gabbro, and an anorthositic or plagioclase–phyric gabbro, lying south of Rupert Lake. Along the western side of this body, a unit of plagioclase–phyric gabbro is in sheared contact with pillowed basalt in the south, and medium–grained amphibole–phyric flows in the north, near the Maybrun Road. No primary sulphides were observed in this gabbro. Pyrite and chalcopyrite occur locally within the shear. Analytical results of samples of sheared and unsheared plagioclase–rich rock are presented in Table 2.5, Samples 2 through 8. Analytical results from other samples in the Rupert Lake Intrusion are given in Table 2.5, Samples 1, 9, and 57.

Empire Lake Intrusion

Gabbroic rocks of the Empire Lake Intrusion occur within a major northeast–trending deformation zone. The author only briefly visited the intrusion: lithologies, as described by Davies (1973), consist of a medium– to coarse–grained, dark–weathering gabbro, that contains inclusions of basalt, and a distinctive porphyritic anorthositic phase containing rounded plagioclase up to 3 cm in diameter. Rounded hornblende crystals in the gabbro are interpreted by Davies (1973) to have been produced as a result of movement during "consolidation". The plagioclase–porphyritic phase is irregularly distributed at the northern and southern ends of the intrusion. This unit is similar to the plagioclase–porphyritic gabbros in the Rupert Lake Gabbro. A lens–shaped intrusive breccia of amphibolite–norite, measuring 400 m in a northeast direction by 100 m at its widest point, is located 100 m west of the northern tip of Kathleen Lake, to the north of Empire Lake. This breccia hosts nickel– and copper–

bearing sulphides, and led to development of the Kenbridge Nickel Mine.

KENBRIDGE NICKEL MINE

An account of the history of exploration on the property is provided by Davies (1973) and Barker (1961). A shaft, collared in 1955 by Kenbridge Nickel Mines Limited, a subsidiary of Falconbridge Nickel Mines Limited, was sunk to 2042 feet with stations cut at 150–foot intervals; and development, drifting, and crosscutting was done on the 350– and 500–foot levels. As of May 14th, 1957, the property had indicated reserves of 3 271 390 tons grading 1.06 percent nickel and 0.54 percent copper (Davies 1973).

The deposit, as described by Barker (1961) and Davies (1973), is hosted within a vertically dipping, heterolithic, amphibolite–norite intrusive breccia, bounded on either side by intense shear zones, giving the body a lensoidal shape in plan. Blocks varying from tens of metres down to tens of centimetres are angular, and show little evidence of assimilation. The fragments are composed of diorite, amphibolite, norite, mafic metavolcanics, and porphyritic anorthositic gabbro, within an amphibolite–norite matrix. The breccia is cut by late felsite dikes.

Chalcopyrite, pyrrhotite, and pentlandite are, for the most part, hosted by the matrix of the breccia. Sulphides occur as net–textured ore, as massive ore, as blebs, and in fractures. Chalcopyrite decreases with respect to pyrrhotite and pentlandite with increasing sulphide content. An examination of the ore zones on the 350–foot level superimposed on the 500–foot level suggests that the ore zones may plunge to the northeast.

Naldrett (1982) gives the following results averaged from analysis of seven samples at Kenbridge: 8.58 percent nickel, 2.32 percent copper, 0.210 percent cobalt, 790 ppb platinum, 280 ppb palladium, 30 ppb rhodium, 16 ppb ruthenium, 15 ppb iridium, 17 ppb osmium, and 675 ppb gold (all results recalculated to metal in 100 percent sulphide).

Entwine Lake Intrusion

The Entwine Lake Intrusion covers 200 km² in the Eagle Rock Lake area 75 km south of Dryden, and lies within the Irene–Eltrut lakes batholithic complex. Davies (1965) identified three major phases: an augite syenodiorite that occupies the eastern arm of the intrusion; a biotite–augite diorite in the main (western) part of the intrusion; and also in the main part of the intrusion, a porphyritic monzonite. A narrow rim of amphibolite that surrounds the northern, western, and southern edges of the intrusion, was interpreted by Davies (1965) to be basalt flows into which the intrusion was emplaced. A small body of hornblende peridotite occurs in the centre of the intrusion. Three sulphide occurrences are indicated on Davies' (1965) map, distributed around and close to the edge of the intrusion. A fourth sulphide showing, the Jock Lake Occurrence, not identified by Davies' reconnaissance mapping, was subsequently discovered in the northern part of the intrusion, within the biotite–augite diorite.

JOCK LAKE OCCURRENCE

The Jock Lake Occurrence was investigated by Noranda Mines Ltd. from 1969 to 1974. Electromagnetic, magnetic, and IP surveys, and ten diamond–drill holes for a total of 3491 feet, were completed on the property. No further work was done at the occurrence until 1986, when reconnaissance by BP Resources Canada Limited indicated anomalous PGE values in samples taken from Noranda Mines' abandoned diamond–drill core. A total of 617 claims were staked, covering the entire intrusion as it was known at that time. An airborne calculated gradiometer and EM survey was flown over the block in 1987. In 1988, detailed geologic mapping and sampling of the Jock Lake Occurrence, claim–line reconnaissance mapping, and sampling over the entire claim group was done. Diamond drilling on the Jock Lake Occurrence commenced in November 1988 (G. Campbell, Geologist, BP Resources Canada Limited, personal communication, 1988).

As reported previously (Blackburn *et al.* 1988), grab samples taken from the occurrence in 1987 returned the following ranges on analysis: 200 to 415 ppb gold; 212 to 545 ppb platinum; and 450 to 840 ppb palladium, though considerably higher values have been obtained in detailed sampling programs.

The writer visited the Jock Lake Occurrence in 1988, and the following description incorporates observations made at that time, augmented by G. Campbell, Geologist, BP Resources Canada Limited (personal communication, 1988). A west–northwest–trending, 800 m long zone of discontinuous sulphide mineralization that contains anomalous PGE is offset by sinistral north–trending faults. The host for the mineralization is a porphyritic gabbro phase of Davies' (1965) biotite–augite diorite. At the eastern end of the zone, the porphyritic gabbro is characterized by a purple colour and is strongly magnetic, possibly representing an oxidizing event in the magma. Further east again, at the end of the zone, a north–trending breccia cuts the porphyritic gabbro and postdates mineralization. A porphyritic monzonite intrudes the porphyritic gabbro at the western end of the mineralized zone, and trenches in the vicinity of this intrusion give the best PGE values.

Saussuritization accompanies the mineralization, and occurs locally throughout the zone, particularly at the western end. Disseminated pyrrhotite, chalcopyrite, and pyrite occur as net textures around ferromagnesian minerals, and in the veins associated with saussuritization, where PGE are present. Saussuritization gives the purple gabbros a bleached appearance. Local patches of magnetic melanogabbro to leucogabbro occur sporadically along the zone. At the eastern end of the mineralized zone, bands of magnetic clinopyroxenite, 2 to 50 cm thick, occur 50 m northwest of the breccia. These bands are not continuous along strike for more than 5 to 10 m, and may represent a fluidization event related to the breccia rather than primary layering. A unique 1 to 2 m wide, north–trending, ultramafic dike cuts the western end of the zone and postdates mineralization. This, and another north–trending dike located on the southwestern side of Jock Lake, appear to have been intruded into pre–existing north–trending faults.

In summary, primary pyrrhotite and chalcopyrite appear to have been deposited in a linear zone near the margin of Davies' (1965) biotite–augite diorite, within a porphyritic gabbro phase. Late enrichment of this mineralization, accompanied by saussuritization, may be due to intrusion of the porphyritic monzonite. A similar environment for PGEs has been described in the Coryell alkalic intrusions in British Columbia (Hulbert *et al.* 1988). MacDonald and Cherry (1988) noted that the alkalic suite of porphyry copper deposits has been shown to contain elevated PGE levels: a similar type of enrichment may have occurred at the Jock Lake Occurrence.

Samuels Lake Intrusion

The Samuels Lake Intrusion, in the Factor Lake and Beaverhouse Lake areas, is one of six alkalic gabbroic–pyroxenitic bodies cutting the Quetico sediments southeast of Mine Centre. None of these intrusions have been previously described in the geological literature, but are indicated on the regional compilation map (Blackburn 1981b). The intrusions are defined by circular magnetic highs on airborne magnetic maps. At one of these, at Redhorse Lake, a copper–nickel occurrence is reported (The Northern Miner, March 7, 1988) to have returned analyses up to 2.2 g/t palladium, 1.35 g/t platinum, and 0.55 g/t gold, and is currently being evaluated by Freewest Resources Incorporated in an option agreement with Ashton Mining Limited.

The Samuels Lake Intrusion is accessible by the Flanders Road, 14.5 km south from Highway 11, and is exposed on islands and a peninsula on Samuels Lake, a small lake about 3 km south of Kirk Lake. Metasediments of the Quetico Subprovince occur around the edge of the lake. A coarse–grained magnetic pyroxenite core has been intruded by a hornblendite, as indicated by xenoliths of the former in the latter at their contact, exposed on the peninsula. The magnetic pyroxenite contains 1 to 2 percent sericite and may contain patches of sulphides (pyrrhotite, pyrite ± trace chalcopyrite) up to 0.25 m across. The coarse–grained magnetic pyroxenite weathers buff brown, with a knobby and pitted surface. The hornblendite is composed of 0.5 cm by 1.5 cm prismatic laths of edenite that constitute 80 percent of the rock, in a matrix of phlogopite, plagioclase, and chlorite, all identified by X–ray diffraction (Ontario Geological Survey, Geoscience Laboratories, Toronto).

A breccia zone is exposed on the northern side of the east–trending peninsula. Subangular to angular fragments of coarse–grained magnetic pyroxenite and of hornblendite occur in a plagioclase–rich matrix. This breccia is within 15 m of the contact between the two rock types.

Pyrrhotite, pyrite, and trace chalcopyrite were observed associated with north–trending shears at the contact between the coarse–grained magnetic pyroxenite and the hornblendite. A composite grab sample from this area returned values of 200 ppb gold, 1550 ppb platinum, 2450 ppb palladium, 2350 ppm copper, 545 ppm nickel, and 1410 ppm chromium upon analysis (Ontario Geological Survey, Geoscience Laboratories, Toronto). Further analyses of samples from outcrops of the Samuels Lake Intrusion on the islands and peninsula are given in Table 2.5, Samples 74 through 84.

At the time of writing, R. Pitkanen (Prospector, Fort Frances) held six claims at Samuels Lake.

Pipestone Peninsula Sills

The Pipestone Peninsula sills, in the Bigstone Bay and Whitefish Bay areas, Lake of the Woods, are a series of conformable, differentiated, locally layered, ultramafic to mafic intrusions that occur at the transition from a mafic metavolcanic sequence to a felsic metavolcanic sequence. They extend from Witch Bay in the east to Hades Islands in the west. Tight folding and shearing parallel to the sills has complicated delineation of separate sills (Ayer *et al.* 1987).

The following selected major and trace element analyses of samples of rocks typical of differentiated phases of the intrusions are taken from Ayer *et al.* (1987): dunite, Andrew Bay—arsenic 300 ppm, chromium 1530 ppm, nickel 1260 ppm, copper 9 ppm, cobalt 104 ppm, MgO 27.2 percent, Fe_2O_3 15.5 percent; pyroxenite, Hades Island—arsenic <10 ppm, chromium 2010 ppm, nickel 235 ppm, copper 64 ppm, cobalt 46 ppm, MgO 14.60 percent, Fe_2O_3 8.97 percent; gabbro, Hades Island—arsenic <10 ppm, chromium 785 ppm, nickel 188 ppm, copper 32 ppm, cobalt 60 ppm, MgO 11.30 percent, Fe_2O_3 14.00 percent; and leucogabbro, Hades Island—arsenic 60 ppm, chromium 75 ppm, nickel 89 ppm, copper 60 ppm, cobalt 42 ppm, MgO 6.68 percent, Fe_2O_3 10.60 percent.

Analytical results of samples collected in 1987 during this study, on a traverse north from the Wendigo Mine to Lac Labelle, and from the Hades Islands, are presented in Table 2.5, Samples 58 through 67 and 68 through 73, respectively. Sample 58 was collected from a quartz vein at the Wendigo Mine shaft, Sample 59 was collected from the waste dump at the Wendigo Mine as a representative of sulphide-rich material, and Sample 61 was collected from the tailings.

Caliper Lake Intrusion

The Caliper Lake Intrusion, Claxton Township, is an approximately 10 km^2 ultramafic to mafic enclave in the Sabaskong Batholith, about 10 km south of Nestor Falls. Highway 71 cuts through the eastern end of the intrusion. The Caliper Lake Intrusion has been described previously by Edwards (*in* Blackburn *et al.* 1982, p.95) as a talcose peridotite, amphibolitized peridotite, and amphibolite intruded by melanogabbro, gabbro, diorite, tonalite, and trondhjemite. Agmatitic dikes, pegmatitic hornblende dikes, veins of apatite and magnetite, and veins of bluish green serpentine occur locally.

Reconnaissance by the author suggests the intrusion to be a series of north-trending, xenolithic-rich, downfaulted blocks centred on Caliper Lake and containing a variety of mafic metavolcanic and ultramafic intrusive lithologies. Analyses of samples from the Caliper Lake Intrusion are given in Table 2.5, Samples 85 through 95.

Discussion

Sulphides in these mafic to ultramafic intrusions are for the most part magmatic. However, partial remobilization is apparent in a number of cases. At Atikwa Lake, northeast-trending shears have been mentioned as a locus of sulphide and gold mineralization in the Denmark Lake Intrusion, and there is an association of sulphides with late diorite intrusive events in places.

Two parallel, east-trending faults, one at Overflow Bay, and the other 2.5 km to the south, between Denmark Lake and Rainmaker Lake, that cut the Overflow Bay and Denmark Lake intrusions (*see* Figure 2.6), may have been long-lived, and the locus of emplacement, like the northeast-trending faults, of some of the diorites. At any event, later movement along them, documented as vertical with a left-lateral component by Davies (1973), has influenced the spatial distribution of ultramafic rocks, and could also have provided channels for hydrothermal solutions that could have redistributed metallic elements.

Recommendations for Exploration

Analytical results from the intrusions discussed here (*see* Table 2.5) indicate the best potential for discovery of further sulphide occurrences with elevated PGE values lies in the Entwine Lake Intrusion, and in the as yet untested alkalic gabbroid bodies, like the Samuels Lake Intrusion, within the Quetico sediments.

Intrusions at Atikwa Lake hold further potential for discovery of copper-nickel deposits, but PGE abundances do not appear to be particularly high. However, further investigation of sulphidic zones in intrusion breccias, particularly in proximity to faults and shear zones, could be productive.

There is some evidence of elevated arsenic values in gold occurrences associated with the Pipestone Peninsula sills. Hydrothermal fluids that transport gold and arsenic in such situations have been postulated to be capable of transporting PGEs in addition, although examples are rare (Hulbert *et al.* 1988; Mountain and Wood 1988). Given the environment of deformation associated with the Pipestone Peninsula sills, there is the possibility that hydrothermal solutions that concentrate gold could also concentrate PGEs.

Other alkalic gabbroic intrusions, such as the Falcon Island Stock and a body north of Northwest Angle Inlet, recently mapped by Ayer (1988b) and Morrice (1988) respectively, may have potential for PGE mineralization. A sample from the latter intrusion, with no visible sulphides, gave an analysis of 35 ppb platinum and 21 ppb palladium (Morrice 1988).

GEOLOGICAL DATA INVENTORY FOLIOS

Compilation of Geological Data Inventory Folios (GDIFs), currently funded under COMDA, commenced in the Kenora Resident Geologist's District in 1985. By the end of 1988, 24 GDIFs have been released (*see* Figure 2.7); twelve more are in preparation and can be viewed at the Resident Geologist's Office.

Emphasis has been placed on coverage in the following areas: the area under investigation by the Dryden Area Economic Geologist program, also funded under COMDA, where 13 folios have been released; the northwestern part of the Kenora District, where there has been renewed interest in the Rex-Werner lakes area, where ultramafic intrusions host copper-nickel deposits, in this case for their PGE potential, and where there has been recent and ongoing exploration for gold and base metals in the Eagle-Rickaby lakes and Treelined-Lennan lakes area; that part of Lake of the Woods that has been mapped at detailed scale by Ontario Geological Survey field parties over the past few years (Figure 2.2); and the area east of Mine Centre, where there is continuing exploration for gold and base metals.

Geological Data Inventory Folios provide a map-based index, not only to assessment files in the Kenora Resident Geologist's Office, but to all other available minerals-related data in the area of coverage.

DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library serves three of the six Resident Geologist's Districts in northwestern Ontario: Kenora, Patricia (Sioux Lookout), and Red Lake. Core stored consists of entire drillholes from both exploration and mine development drilling, in-

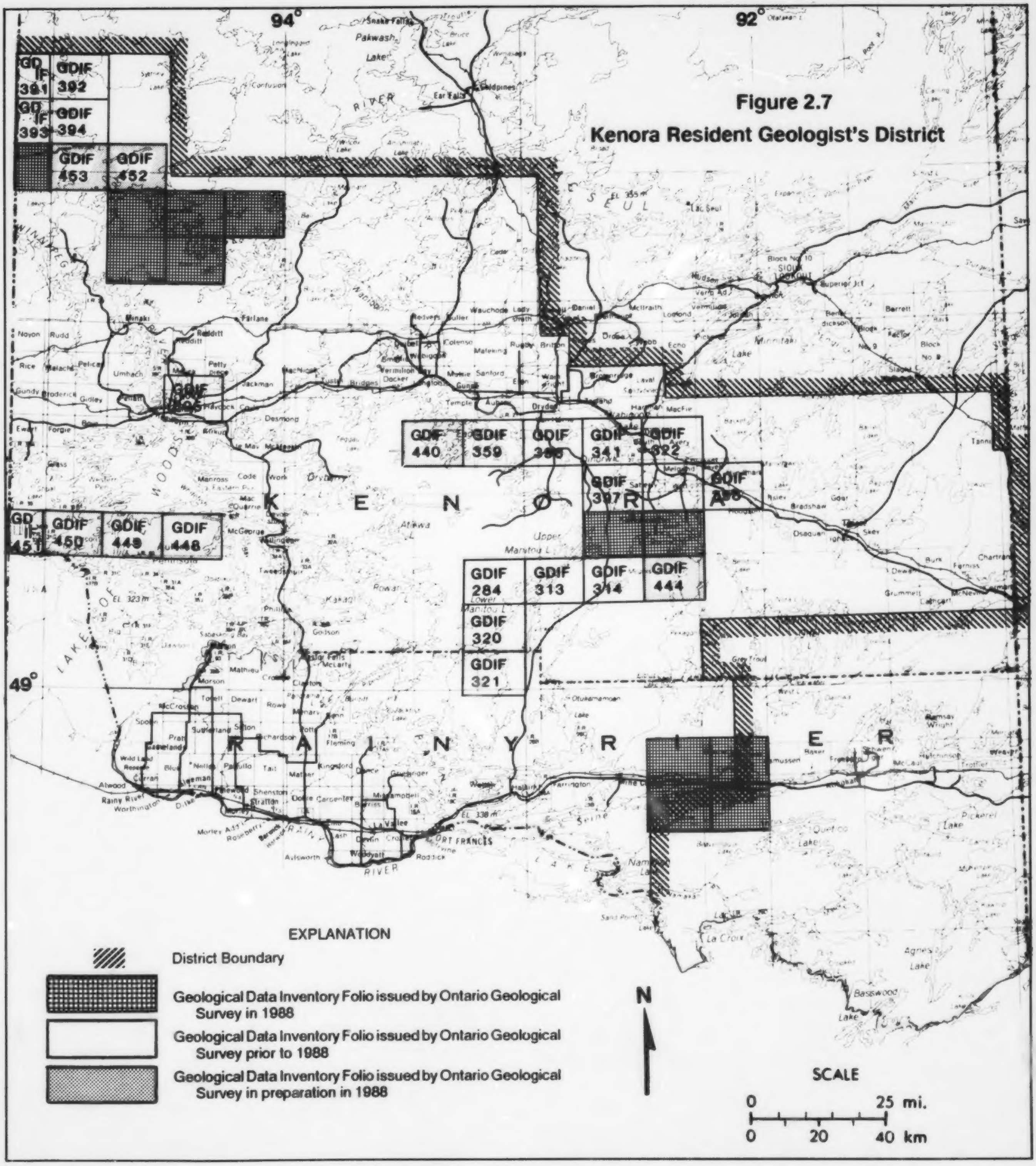


Figure 2.7
Kenora Resident Geologist's District

94°
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GDIF 450
GDIF 449
GDIF 448
GDIF 284
GDIF 313
GDIF 314
GDIF 444
GDIF 320
GDIF 321
K E N O R A
R A I N Y R I V E R
Pakwash Lake
Ear Falls
Lac Seul
Sioux Lookout
Dryden
Upper Manitou L.
Lower Manitou L.
Fort Frances
Rainy River
Lake of the Woods
Basswood Lake
Agnes Lake
La Croix
EXPLANATION
District Boundary
Geological Data Inventory Folio issued by Ontario Geological Survey in 1988
Geological Data Inventory Folio issued by Ontario Geological Survey prior to 1988
Geological Data Inventory Folio issued by Ontario Geological Survey in preparation in 1988
N
SCALE
0
25 mi.
0
20
40 km

complete holes recovered from old drill sites, and short samples of core submitted for credit under Section 77(6) of the Mining Act (RSO 1980).

Core from the Kenora District, collected between December 1, 1987 and November 20, 1988, totals 14 994.2 m. The current content of the library consists of 38 917.3 m completely catalogued core stored inside the building (24 717.7 m from Kenora) and 17 450.0 m in secure outdoor storage on pallets (11 984.0 m from Kenora). Core in outdoor storage consists of excess core from several drilling projects that were collected in their entirety, core that has been culled from the system, and surplus core, after some holes were re-logged and reduced.

Use of the core library by industry and government increased during 1988. A total of 107 visits were made by industry personnel compared with 68 in 1987, and 44 visits were made by government personnel (both provincial and federal). A total of 83.5 man-days were spent by industry personnel examining and logging drill core.

Much of the core in the library is from recent gold exploration, particularly that from the Red Lake District. Emphasis has been placed on collecting core from the more remote parts of the area north and east of Red Lake and Sioux Lookout, and from some of the former mines. Further discussion of core collected in Red Lake and Sioux Lookout Districts can be found in the reports of the Red Lake and Sioux Lookout Resident Geologists, this volume.

Core from a total of 318 drillholes in the Kenora District is stored in the main part of the collection with another 143 holes in outdoor storage. As with the other districts, most of this was drilled during gold exploration. Gold occurrences in the Shoal Lake, Lake of the Woods, Cameron Lake–Rowan Lake, Dryden, Mine Centre, and Kenora areas are represented. Drillholes representing sections through the host rock and mineralized zone of many occurrences are available.

In addition to core from gold occurrences, the core library contains the last available core from the Gordon Lake Mine of Consolidated Canadian Faraday at Werner Lake. This old nickel and copper mine contained significant platinum group minerals and produced platinum as a by-product. Current interest in platinum group metals has led to renewed exploration in the Werner Lake–Rex Lake area: core drilled by International Platinum Corporation in 1987 is presently available for examination at the Core Library.

Core samples from base and precious metal exploration by Kerr-Addison Mines Limited in the Lake of the Woods area, and Hudson Bay Exploration and Development in the Weller Lake and Otukamamoan Lake areas, both in the early to mid-1970s, that were submitted for assessment credit, are the only remaining core from these projects. Core from rare element pegmatite exploration by Selco Mining Corporation in the Dryden area and core from one of the last uranium-bearing pegmatites to be drilled near Kenora are also available.

Drill core collected in 1988 is listed in Table 2.4 and sites are shown in Figure 2.2.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

During the 1988 field season, the following field parties from the Precambrian Geology, and Engineering and Terrain Geology sections operated within the Kenora Mining Division, at sites shown in Figure 2.6.

A. J. Ayer (Precambrian Geology Section) conducted detailed mapping (1:15 840) of the Falcon Island area of Lake of the Woods.

B. A.F. Bajc (Engineering and Terrain Geology Section) continued surficial geological mapping and supervised overburden drilling in the Fort Frances–Rainy River area.

C. B. Berger (Precambrian Geology Section) conducted detailed mapping (1:15 840) in the Manitou Stretch area of Lower Manitou Lake.

D. L.B. Chorlton (Precambrian Geology Section) completed stratigraphic, structural, and metallogenetic studies of the Dinorwic area.

E. P.M. Smith (Precambrian Geology Section) conducted detailed mapping (1:15 840) in the Vista Lake area.

F. S. Szoke (Engineering and Terrain Geology Section) and staff of the Aggregate Assessment Office commenced an inventory of the aggregate resources in the Rainy Lake to Pipestone Lake area.

The above projects, A through F, were funded under the Canada–Ontario Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA), with joint funding by the governments of Canada and Ontario.

G. F. Breaks (Precambrian Geology Section) investigated the Petrunka tungsten–beryllium property in Zealand Township.

H. M. Sanborn–Barrie (Precambrian Geology Section) investigated the boundary relationships between the Winnipeg River and English River subprovinces north of Kenora and Dryden.

G.P. Beakhouse (Precambrian Geology Section) investigated granitic batholiths throughout the District, and the Wabigoon–Winnipeg River Subprovince boundary.

TABLE 2.6. MAPS AND REPORTS PERTAINING TO THE KENORA RESIDENT GEOLOGIST'S DISTRICT, ISSUED BY THE ONTARIO GEOLOGICAL SURVEY, 1988.

Airborne Aeromagnetic Vertical Gradient and Total Field Surveys	
GSC Open File 1824	High Resolution Aeromagnetic Vertical Gradient and Total Field Surveys in the Kenora-Fort Frances Area
Maps	
Map 2065 (Reprint)	Atikokan-Lakehead Sheet, Geological Compilation Series, Kenora, Rainy River and Thunder Bay Districts
Map 2175 (Reprint)	Red Lake-Birch Lake Sheet, Geological Compilation Series, Kenora District
Open File Reports	
OFR 5680	Geology of the Melgund Lake Area, District of Kenora
OFR 5682	Structure and Metallogenetic Studies in the Flint-Cameron Lakes Area, District of Kenora
OFR 5683	Geology of the Northwest Angle Inlet Area, Lake of the Woods, District of Kenora
OFR 5684	Geology of the Clearwater Bay Area, District of Kenora
OFR 5689	Ontario Geoscience Research Grant Program, Grant No. 193, Geological Setting, Structure and Alteration Associated with Gold-Pyrite Mineralization in Mafic Volcanic Rocks at Cameron Lake, Wabigoon Subprovince, Northwestern Ontario
OFR 5695	The Geological Setting of Gold Occurrences in the Lake of the Woods Area, District of Kenora
Preliminary Maps, Geological Series	
P. 3108	Precambrian Geology of Laval Township, District of Kenora (52F/15, 16)
P. 3109	Precambrian Geology of Hartman Township, District of Kenora (52F/09, 10, 15, 16)
P. 3110	Precambrian Geology of the Rainy River Area, District of Rainy River (52D/09, 10, 15, 16)
P. 3111	Precambrian Geology of the Flambeau Lake-Larson Bay Area, Western Part, District of Kenora (52F/10)
P. 3112	Precambrian Geology of the Flambeau Lake-Larson Bay Area, Eastern Part, District of Kenora (52F/10)
P. 3120	Precambrian Geology of the Monument Bay Area, Lake of the Woods, District of Kenora (52E/10)
P. 3121	Precambrian Geology of the Chisholm Island Area, Lake of the Woods, District of Kenora (52E/07, 08, 09, 10)
P. 3140	Gold Grains in Rotasonic Drill Core and Surface Samples (1987-1988), Fort Frances-Rainy River Area, District of Rainy River
Miscellaneous Papers	
MP 138	Report of Activities 1987, Resident Geologists
MP 140	Geoscience Research Grant Program, Summary of Research, 1987-1988
MP 141	Summary of Field Work and Other Activities 1988, by the Ontario Geological Survey
Geological Data Inventory Folios	
GDIF 440	Garnet Bay Area, District of Kenora (52F/11 NW)
GDIF 444	Wapageisi Lake Area, District of Kenora (52F/08 SW)
GDIF 448	Aulneau Peninsula Area, District of Kenora (52E/08 NW)
GDIF 449	Astron Bay Area, District of Kenora (52E/07 NE)
GDIF 450	Monument Bay Area, District of Kenora (52E/07 NW)
GDIF 451	Moosin Bay Area, District of Kenora (52E/06 NE)
GDIF 452	Rex Lake Area, District of Kenora, Patricia Portion (52L/07 NE)
GDIF 453	Werner Lake Area, District of Kenora, Patricia Portion (52L/07 NW)

RESEARCH BY OTHER AGENCIES

UNIVERSITY THESES

Geological theses related to the Kenora Mining Division, believed to be in progress or completed, during 1988, are as follows:

Bachelors Theses

J. Halstead commenced a study on the nature and origin of northeast derived till in the Fort Frances–Rainy River area (Brock University, St. Catherines).

R. Shaver commenced a petrographic and petrological study of a possible ash flow sequence in the Lower Manitou Lake area (Brock University, St. Catherines).

Masters Theses

S. Schaeffer commenced a comparative study of the Ash Rock, Steeprock Mine area, and the ultramafic tuff in the Rice Bay dome (University of Minnesota, Duluth, Minnesota).

T. Warman continued a study of the geochemistry, sedimentology, and history of sedimentation of the red varved clays at Dryden (University of Manitoba, Winnipeg).

Doctoral Theses

A.F. Bajc commenced a study of the glacial and glacio–lacustrine history of the Fort Frances–Rainy River area (University of Waterloo, Waterloo).

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

R.P. Taylor, D.H. Watkinson, and D.H. Melling, all of Carleton University, concluded a program of geological, fluid inclusion, and isotopic studies of gold–bearing vein systems in the Cameron Lake and Monte Cristo shear zones (Grant 323), that was initiated in 1987.

OTHER RESEARCH

G.V. Minning, Geologist, GVM Geological Consultants Limited, continued the 1:50 000 scale Quaternary mapping program of National Topographic System Map Sheet NTS 52F which commenced in 1987. This program is being carried out under the federal component of COMDA.

G.R. Edwards and M.R. Stauffer, of the University of Saskatchewan, investigated the stratigraphy and structure of metasediments and metavolcanics at the east end of Pipestone Lake, 60 km north of Fort Frances.

D.R. Sharpe, Geologist, Terrain Sciences Division, Geological Survey of Canada (GSC) supervised an overburden drilling program in the Dryden clay plain to determine the nature and environment of deposition of the varved clays in the area.

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1988: Aeromagnetic Vertical Gradient and Total Field Surveys, Kenora-Fort Frances Area, District of Kenora; flown by Kenting Earth Sciences International Limited and processed by Geoterrex Limited for the Geological Survey of Canada, Open File Report 1824, 20 maps, Scale 1:50 000, Survey completed June, 1987.

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1979: A Study of the Petrology of Granitic Rocks in the Tustin-Bridges Area, Northwestern Ontario; Unpublished PhD Thesis, University of Saskatchewan, Saskatoon, 191p.

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3. Red Lake Resident Geologist's District—1988

B. Atkinson[1], and C.C. Storey[2]

[1]Resident Geologist, Ministry of Northern Development and Mines, Red Lake.

[2]Drill Core Library Geologist, Ministry of Northern Development and Mines, Kenora.

INTRODUCTION

To the end of November, 173 923 man–days of diamond drilling were recorded for assessment credits. This is more than double the amount of drilling recorded for any previous year. Several major exploration programs, on leased or patented ground, also received substantial diamond drilling which is in addition to footage reported for assessment credits. For the first 11 months of 1988, geophysical work–day credits were over 212 700 man–days. Total assessment credits for the same period have not been this high since 1970, when the South Bay Mine was discovered. However, the claim staking activity and number of active claims is returning to more normal levels, possibly reflecting the phasing out of flow through share funding.

Table 3.1 lists a summary of claims recorded and assessment work credits in the Red Lake Resident Geologist's District.

Throughout the district, exploration activity concentrated on gold, but towards the latter part of the year, base metals were again being sought by several companies. There were 18 active Ontario Mineral Exploration Programs (OMEP) in the district in 1988.

MINING ACTIVITY

Campbell Red Lake Mine (Placer Dome Inc.) and the Arthur W. White Mine (Dickenson Mines Ltd.) continued as the only two producing mines in the district.

In addition to regular gold production from the two active mines, Goldquest Exploration Inc. shipped 2482 short tons of ore from the Lake Rowan Mine, Todd Township, to the Arthur W. White Mill. Milling of this ore yielded 610 troy ounces of gold for an average grade of 0.25 ounce per ton. Total production figures for the Lake Rowan Mine are 13 023 short tons of ore milled,

TABLE 3.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	2, 286	2, 368	10, 935	175, 600	215, 300	42, 666	457, 500
1987	4, 512	1, 708	11, 017	81, 854	138, 443	23, 440	261, 741
1986	3, 803	1, 598	10, 427	48, 325	127, 445	6, 360	189, 633
1985	2, 673	2, 260	8, 212	42, 000	201, 052	16, 642	269, 262
1984	4, 344	1, 725	7, 799	32, 588	78, 538	12, 495	128, 664
1983	2, 407	1, 204	5, 180	18, 637	22, 035	3, 468	53, 207
1982	942	1, 884	3, 992	23, 967	79, 662	6, 787	118, 775
1981	1, 719	1, 249	4, 889	28, 771	66, 000	8, 182	107, 430
1980	2, 220	1, 115	4, 301	38, 482	30, 240	871	71, 975
1979	1, 068	1, 763	3, 221	21, 108	38, 380	3, 154	62, 949
1978	1, 207	1, 521	3, 916	25, 574	19, 496	2, 480	50, 997
1977	2, 324	2, 395	4, 261	12, 994	45, 080	620	59, 196
1976	2, 705	1, 382	4, 332	18, 680	23, 578	380	46, 544
1975	1, 368	2, 059	2, 957	29, 377	12, 714	960	44, 717
1974	1, 339	1, 829	3, 648	47, 362	5, 660	3, 040	57, 719
1973	1, 616	3, 157	4, 009	60, 027	20, 474	NIL	83, 019
1972	2, 219	5, 284	5, 588	34, 261	14, 858	5, 216	56, 173
1971	1, 541	4, 922	8, 486	73, 019	50, 920	2, 243	127, 556
1970	3, 971	7, 194	11, 759	73, 886	329, 065	17, 606	427, 527
1969	10, 999	933	14, 772	49, 212	66, 032	1, 320	119, 039
1968	2, 451	1, 702	4, 784	15, 367	48, 800	1, 228	65, 395

which produced 1298 ounces gold for a recovered grade of 0.10 ounce gold per ton (D.L. Sannes, Senior Exploration Geologist, Goldquest Exploration Inc., personal communication, 1988).

PLACER DOME INC., CAMPBELL RED LAKE MINE

The Campbell Red Lake Mine anticipates this year's gold production will exceed 242 000 ounces from 417 000 tons of ore milled. The current milling rate is 1140 tons of ore per day, and the average operating head grade is 0.596 ounce gold per ton. Previously, the mill recovery was 94.8 percent, and the newly installed carbon columns have increased the total recovery to 95.3 percent. Expenditures for the year totalled $9 million. All ore zones at the mine contributed to production, and there were 53 active headings, 43 of which were producing ore.

Development work will amount to 3993 m for the year and underground diamond drilling of orebodies is projected to be 18 288 m. New development work on the 22 and 23 levels is concentrating on the downdip extension of producing ore zones.

Cut–and–fill mining accounts for 85 percent of the ore production while long–hole stoping accounts for the remaining production.

Personnel employed at the mine include 284 in the Mine Department, 46 in the mill, 117 in the plant, and 34 in administration, for a total of 481 employees in the work force (S. Reid, General Mine Manager, Campbell Red Lake Mine, personal communication, 1988; R. Church, Chief Geologist, Campbell Red Lake Mine, personal communication, 1988).

DICKENSON MINES LTD., ARTHUR W. WHITE MINE

Dickenson Mines Ltd. acquired 100 percent ownership of the Arthur W. White Mine by purchasing Cambior Inc.'s 34 percent interest for $52 million, plus working capital adjustments (The Northern Miner, July 4, 1988).

Proven reserves as of January 1988 stand at 1 548 975 tons of ore grading 0.34 ounce gold per ton. Probable reserves are 1 777 555 tons of ore at 0.30 ounce gold per ton, and possible reserves are 1 055 297 tons of ore at 0.30 ounce gold per ton.

Ore from the mine is milled at a rate of 700 tons per day. Mining methods include conventional cut–and–fill, and tight cut–and–fill mining with some long–hole sill removal. Ore is drawn from 30 active stopes in all ore zones. Approximately 3000 m of development work, including drifting, stoping, ramping, and crosscutting was performed in 1988. The PLM Zone, a new carbonate zone in the lower levels of the mine, received exploration attention. In addition, both the updip projection of the ESC Ore Zone on the 15th Level, and the downdip projection of the same orebody on the 28 and 29 levels received pilot development.

Personnel employed by the mine totalled 347. Of this total, 190 were employed in the Mine Department, 39 in the mill, 71 in the plant, 21 in geology and engineering, and 26 in administration (J. Rodgers, Chief Geologist, Arthur W. White Mine, personal communication, 1988).

ADVANCED EXPLORATION AND DEVELOPMENT

McFINLEY RED LAKE MINES LTD.

During the year, the McFinley Mine received continued mill tune–up and modification in preparation for bulk sampling. Expenditures for 1988 totalled $5 million. Total expenditure to date is approximately $27 million. A total of 5000 tons of development muck were run through the mill as an initial trial for mill testing. In the plant, the gravity circuit was completed early in the year, and the cyanide circuit was operational mid–year. A Nelson concentrator has been added to the circuit. Mill capacity is 150 tons of ore per day with a targeted production of 200 tons of ore per day when actual bulk sample processing begins. Construction of a tailings pond is now complete.

Underground development work totalled 1200 m of drifting, crosscutting, and raising on the 275 and 400 levels. The bulk of the development work was located south of the shaft.

Six stopes have been readied to supply material to the mill for the bulk sample. Each stope will provide approximately 2000 tons of ore. Stopes to be included in the bulk test are the No. 101, 102, and 103 stopes on the 150 Level, and No. 301, 304, and the C2 chert stopes on the 400 Level. Other stopes have received development work.

Underground diamond drilling will total 15 000 m and is divided equally between stope definition and exploration. Exploration emphasis is directed towards the talc zone, east of the shaft, from the 400 Level (J. Whitton, Mine Manager, McFinley Red Lake Gold Mines Ltd., personal communication, 1988).

NORAMCO EXPLORATIONS INC., BERENS RIVER MINE

After an extensive surface and underground exploration effort carried out in 1987 on this former producer, the mine had only limited exploration in 1988. This included geological mapping and surface diamond drilling totalling 3266 m in 23 holes. Noramco Explorations Inc., operator of the property, indicated confirmed reserves at the mine are 302 500 tons of ore grading 0.21 ounce gold per ton and 4.5 ounces silver per ton (George Cross News Letter, November 25, 1988).

TWIN GOLD MINES LTD.–LINGMAN LAKE

The Twin Gold Mines property is located 314 km north of Red Lake on Lingman Lake. The property consists of 22 claims on which a shaft and underground development work were completed between 1946 and 1948. Exploration on the property this year continued with a major drilling program designed to further define mineralized zones identifed in previous exploration work. Sixty–seven holes totalling 12 669 m were drilled on known mineralized zones. Agassiz Resources Ltd. is the operator of the property.

Equipment to conduct underground exploration remains at Pierce Lake, 50 km north of the mine. The equipment was transported to Pierce Lake via Red Sucker Lake, Manitoba, during the winter of 1987–88, but poor ice conditions prevented transport to the mine (L. Cheng, Comptroller, Agassiz Resources Ltd., personal communication, 1988).

INCO GOLD COMPANY, COCHENOUR–WILLANS MINE

Inco Gold Company, a unit of Inco Ltd., acquired Esso Resources Canada Ltd.'s interest in the Wilanour partnership in March 1988. As the operator, Inco Gold began an exploration program on the Cochenour–Willans Mine in Dome Township. Work has included surface diamond drilling of 14 holes totalling 6589 m, 63 km of line cutting over the property, and magnetic and horizontal loop–electromagnetic (HLEM) surveys. In addition, combined airborne very low frequency–electromagnetic (VLF–EM) and magnetic surveys were flown over the property. Surface mapping and power stripping were carried out on selected sites, and 7620 m of previously drilled core was relogged. Cost of the surface program for 1988 amounted to $1.5 million.

Inco Gold announced an underground program which will include dewatering the Cochenour No. 1 shaft, and 18 288 m of underground diamond drilling at a projected cost of $4.73 million. Shaft dewatering had begun by late November. The exploration effort is directed at four separate mineralized zones.

The four zones include 1) the southern chert zone outlined between the 1425 and 2600 levels; 2) the main sedimentary facies between the 475 and 1675 levels; 3) the downdip plunge of the Annco orebody (previously tested by Esso Resources Canada Ltd.) between the 2200 and 2600 levels; and 4) the northeast extension, located east of the No. 2 shaft below the 150 Level to a depth of 312 m (H. Virtanen and T. Lloyd, Geologists, Inco Gold Management Inc., personal communication, 1988).

EXPLORATION ACTIVITY

Table 3.2 refers to exploration activities in the Red Lake Resident Geologist's District for 1988. Much of the activity was supported by flow through share investments; this financial impetus greatly stimulated exploration throughout the district. As in past years, most of the activity was concentrated in the Uchi Subprovince within the Red Lake and Birch–Confederation lakes greenstone belts. In addition, exploration projects were carried out in a number of the northern greenstone belts including Stull Lake, Sandy Lake, Favourable Lake, Lingman Lake, North Spirit Lake, and Muskrat Dam Lake.

RED LAKE GREENSTONE BELT

Noramco Explorations Inc.

There were 25 diamond drilling programs in the Red Lake greenstone belt. Noramco Explorations was the major player in the camp, and through various affiliated companies, performed drilling exploration on five separate properties. Noramco's Gullrock Lake Property consists of 165 unpatented contiguous claims in Ranger, Willans, Byshe, and Balmer townships. Six holes totalling 986 m were drilled on the property for the year. A total of 607 m was drilled in three holes on the 154–claim group on McKenzie Island–Slate Bay.

Noramco Exploration's Bonanza Property consists of 27 mining leases and one unpatented claim in Dome Township. This property includes White Horse Island, which hosts the Sanshaw Prospect. The property has underground development work, including a shaft to 139 m and 701 m of crosscutting on two levels, performed by Orlac Red Lake Mines Ltd. in 1946 and 1947. The 1961 Financial Post Survey of Mines indicates that the mine has 175 000 tons of ore grading 0.2 ounce gold per ton above the 114 m Level.

During the year, Noramco Explorations carried out magnetic surveys, geological mapping, and diamond drilling of 51 holes totalling 7687 m. Mineralization occurs in strongly sheared granodiorite of the Dome stock, with pyrite as the main sulphide. The operating company, Pure Gold Resources Inc. stated that drilling has confirmed "significant gold mineralization". However, no reserve figures or grades were indicated.

Work by Noramco Exploration's on the Dean Creek Property in Ball Township included diamond drilling of nine holes totalling 1165 m.

Noramco Exploration's Bouzan Lake Property includes the southern part of Heyson Township and extends into Baird and Byshe townships. The property consists of 137 contiguous mining claims. Diamond drilling on the property totalled 2241 m in 11 holes. Drill targets included geophysical anomalies, sites of past trenching, and areas of geological inter-

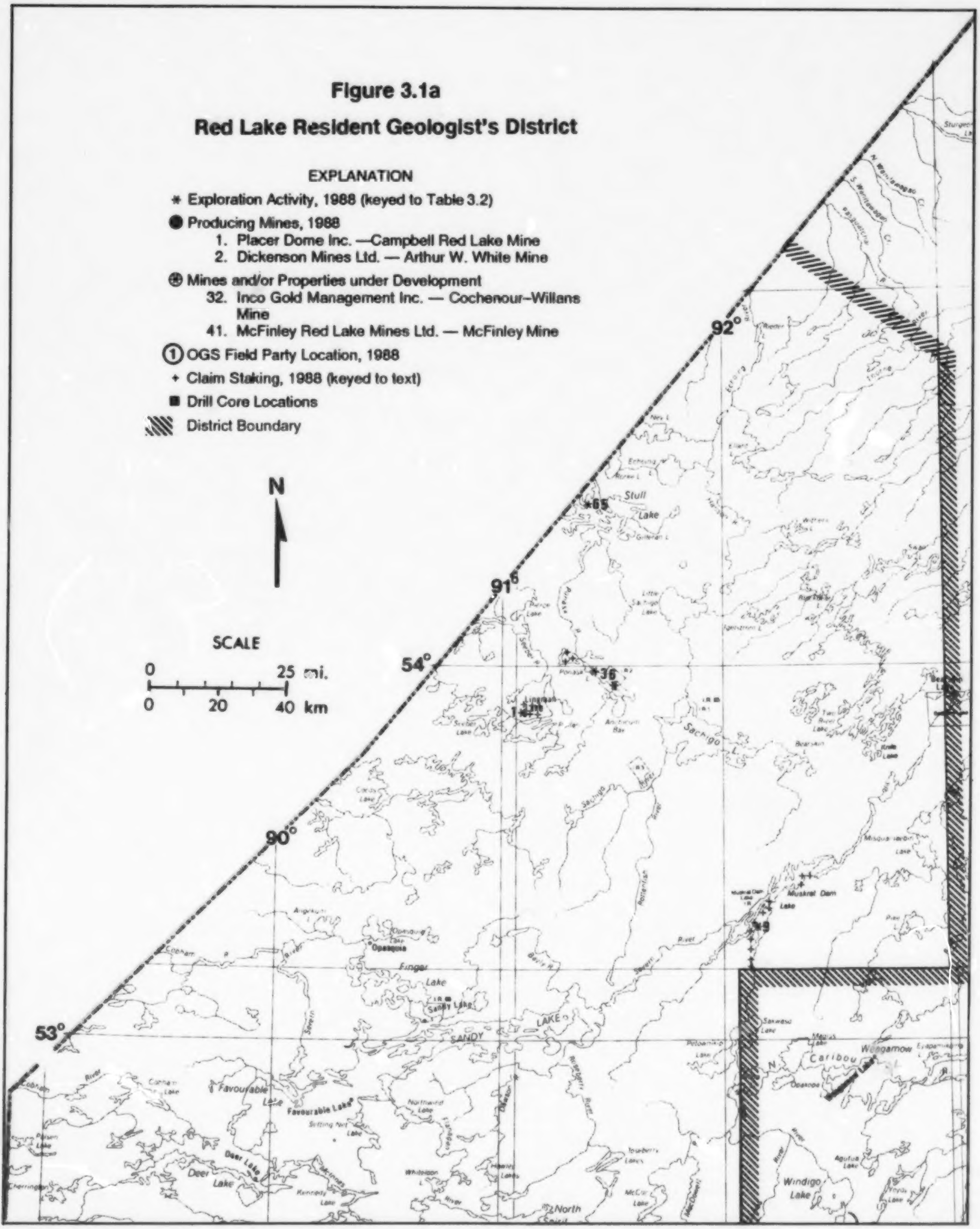


Figure 3.1a
Red Lake Resident Geologist's District

EXPLANATION
* Exploration Activity, 1988 (keyed to Table 3.2)
● Producing Mines, 1988
1. Placer Dome Inc. —Campbell Red Lake Mine
2. Dickenson Mines Ltd. — Arthur W. White Mine
⊕ Mines and/or Properties under Development
32. Inco Gold Management Inc. — Cochenour-Willans Mine
41. McFinley Red Lake Mines Ltd. — McFinley Mine
① OGS Field Party Location, 1988
+ Claim Staking, 1988 (keyed to text)
■ Drill Core Locations
▨ District Boundary
N
SCALE
0
25 mi.
0
20
40 km
92°
91°
54°
90°
53°
*65
Stull Lake
*36
Sachigo L.
Muskrat Dam Lake
*9
Finger Lake
Sandy Lake
SANDY LAKE
Favourable Lake
Deer Lake
Windigo Lake
Caribou
Opasquia
North Spirit
Sakwaso Lake
Misquamaebin Lake
River

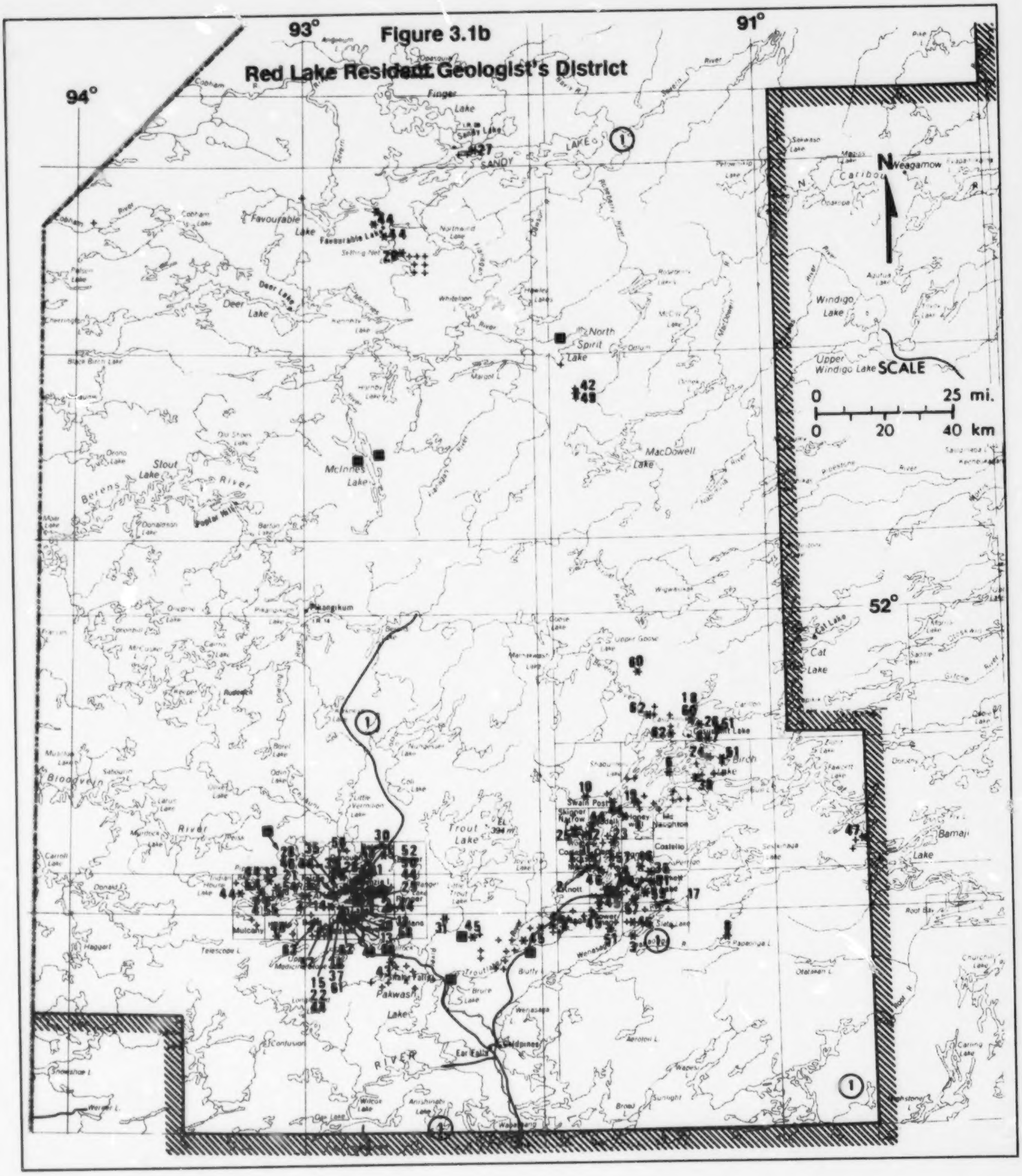


Figure 3.1b

Red Lake Resident Geologist's District

94°
93°
91°
52°
N
SCALE
0
25 mi.
0
20
40 km
Finger Lake
Sandy Lake
SANDY LAKE
Favourable Lake
Setting Net
Northwind Lake
Deer Lake
Cobham River
North Spirit Lake
McInnes Lake
Stout Lake
Berens River
Poplar Hill
Pikangikum
MacDowell Lake
Windigo Lake
Upper Windigo Lake
Weagamow
Caribou
Cat Lake
Upper Goose
Birch Lake
Swain Post
Skinner
Narrow
Costello
McNaughton
Trout Lake
Bloodvein
River
Pakwash
Lake
Mulcahy
Ear Falls
Goldpines
Bamaji
Lake
RIVER
Wabigoon

TABLE 3.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	AGASSIZ RESOURCES LTD./TWIN GOLD MINES LTD.	GEOLOGICAL SURVEY; DIAMOND DRILLING (67)-12669 m; STRIPPING; CHANNEL SAMPLING: LINGMAN LAKE MAP SHEET
2	ALGONQUIN MINERALS INC./ NEXUS RESOURCE CORPORATION	DIAMOND DRILLING (10)-1523.9 m: ONTARIO WOMAN LAKE PROPERTY, DENT TWP.
3	BHP-UTAH MINERALS INTERNATIONAL	GEOLOGICAL SURVEY; LITHOGEOCHEMICAL SAMPLING: FAIRLIE AND TODD TWPS.
		GEOLOGICAL SURVEYS; RECONNAISSANCE MAPPING; SAMPLING: SLATE LAKE MAP SHEET
4	BLACK CLIFF MINES LTD.	GEOPHYSICAL SURVEY: KILLALA TWP.
5	BOBINSKI, M.	MECHANICAL STRIPPING: BATEMAN TWP.
6	BOND GOLD CANADA INC. (FORMERLY ST. JOE CANADA INC.)/NEXUS RESOURCE CORPORATION	GEOLOGICAL, GEOPHYSICAL SURVEYS; DIAMOND DRILLING: HORSESHOE ISLAND AND MCINTYRE BAY PROPERTIES, CASUMMIT LAKE AND SATTERLY LAKE MAP SHEETS
7	BOND GOLD CANADA INC./GABBS RESOURCES LTD./ NEXUS RESOURCE CORPORATION	DIAMOND DRILLING: PENSON LAKE PROPERTY, CASUMMIT LAKE MAP SHEET
8	BUFFALO RESOURCES LTD.	DIAMOND DRILLING (6)-545 m: CURIE LAKE MAP SHEET
9	CAMECO - A CANADIAN MINING AND ENERGY CORPORATION (FORMERLY ELDOR RESOURCES LTD.)	GEOPHYSICAL SURVEYS; DIAMOND DRILLING (5)-585.8 m: KIPPEY PROPERTY, KIPPEN LAKE MAP SHEET
10	CANADIAN EAGLE EXPLORATION INC. (FORMERLY SHABU GOLD MINES LTD.)	AIRBORNE GEOPHYSICAL SURVEY: SHABU LAKE AND SHABUMENI LAKE MAP SHEETS
11	CANADIAN NICKEL COMPANY LIMITED	GEOLOGICAL, GEOPHYSICAL SURVEYS; DIAMOND DRILLING (8)-1010.8 m: SACHIGO RIVER MINE PROPERTY, ALJO LAKE AND LEVITT LAKE MAP SHEETS
12	CANADIAN PATRICIA EXPLORATION LTD.	GEOLOGICAL, GEOPHYSICAL SURVEYS; MECHANICAL STRIPPING; TRENCHING; SAMPLING: SKINNER TWP.
13	CHARLARMAR RESOURCES INC.	MECHANICAL STRIPPING: HEYSON, BYSHE AND BATEMAN TWPS.
14	CHEVRON MINERALS LTD.	GEOPHYSICAL SURVEYS; MECHANICAL STRIPPING AND CHANNEL SAMPLING IN 6 TRENCHES; DIAMOND DRILLING (14)-2680 m: DOME, HEYSON AND FAIRLIE TWPS.
15	DESMEULES, M.	MECHANICAL STRIPPING: HEYSON TWP.
17	DURATION MINES LTD.	56 KM LINE CUTTING: JUBILEE LAKE MAP SHEET
18	ESSO RESOURCES CANADA LTD.	GEOPHYSICAL SURVEYS; ASSAYS AND ANALYSES: CASUMMIT LAKE MAP SHEET
19	FALCONBRIDGE LIMITED	GEOLOGICAL SURVEY; ROCK SAMPLE ANALYSES: HODGSON OPTION PROPERTY, SHABUMENI LAKE MAP SHEET
20	GEOTEST CORPORATION	GEOLOGICAL, AIRBORNE GEOPHYSICAL SURVEYS; ASSAYING: SETTING NET LAKE MAP SHEET
21	GIBSON, R.	DIAMOND DRILLING (3)-113.4 m: TODD TWP.
22	GOLDBRAE DEVELOPMENTS LTD.	GEOLOGICAL SURVEY; MECHANICAL STRIPPING: CARRICONA PROPERTY, HEYSON TWP.
23	GOLD CREST MINERALS LTD.	GEOLOGICAL, GEOPHYSICAL SURVEYS; TRENCH SAMPLING: HUDSON PATRICIA MINE, DENT TWP.
24	GOLD FIELDS CANADIAN MINING, LTD.	GEOLOGICAL SURVEY; TRENCHING; SAMPLING AND EXTENSIVE DIAMOND DRILLING: SPRINGPOLE PROPERTY, CASUMMIT LAKE MAP SHEET
		GEOLOGICAL SURVEY; RECONNAISSANCE EXPLORATION INCLUDING GEOCHEMICAL SURVEY; LIMITED DIAMOND DRILLING: CASUMMIT LAKE, SATTERLY LAKE, KEIGAT LAKE AND SEAGRAVE LAKE MAP SHEETS
		MECHANICAL STRIPPING AND SAMPLING: GERRY LAKE MAP SHEET
25	GOLDEN HAT RESOURCES INC.	DIAMOND DRILLING (5)-189.3 m; CHANNEL SAMPLING: DUNKIN PROPERTY, SKINNER TWP.
26	GOLDEN TERRACE RESOURCES CORPORATION	DIAMOND DRILLING (11)-691.9 m: KOSTYNUK PROPERTY, CASUMMIT LAKE MAP SHEET
27	GOLDEYE EXPLORATIONS LTD.	GEOLOGICAL, AIRBORNE GEOPHYSICAL SURVEY; DIAMOND DRILLING: GRANITE BAY AND RATHOUSE BAY OF SANDY LAKE, SANDY LAKE, RAHILL LAKE AND KAKAPITAM LAKE MAP SHEETS
28	GOLDQUEST EXPLORATION INC.	GEOLOGICAL SURVEYS: REDCON PROPERTY, BATEMAN TWP. AND ROWAN PROPERTY, TODD TWP.
		DIAMOND DRILLING AS FOLLOWS: PROPERTY / TWP. / NO. OF HOLES / TOTAL DRILLED ABINO / DOME/BALMER / 8 / 2,202.0 m DUCHESNE / BATEMAN / 1 / 403.8 m INORE / BATEMAN/MCDONOUGH / 3 / 1,734.5 m REDCON / BALMER / 7 / 2,248.7 m 19 / 6,589.0 m
29	GUNNAR GOLD INC.	GEOPHYSICAL SURVEYS: HEADWAY PROPERTY, DOME TWP.
30	HERBERT, L.	MECHANICAL STRIPPING: HEYSON AND BATEMAN TWPS.
31	HERMISTON, W.	PROSPECTING; TRENCHING: SOUTH OF OTTER LAKE MAP SHEET
32	INCO GOLD MANAGEMENT INC.	GEOLOGICAL, GROUND AND AIRBORNE GEOPHYSICAL SURVEYS; MECHANICAL STRIPPING; 63 KM LINE CUTTING; RELOGGING 7620 m OF CORE; DIAMOND DRILLING (14)-6588 m; COMMENCED DEWATERING NO. 1 SHAFT: COCHENOUR WILLANS MINE, DOME TWP.
33	JAMIE FRONTIER RESOURCES INC.	GEOPHYSICAL SURVEYS; LIMITED UNDERGROUND DRIFTING; CROSS CUTTING: TODD TWP.
34	LAC MINERALS LTD.	AIRBORNE GEOPHYSICAL SURVEYS: UCHI LAKE AND EARNGEY TWP.
35	LAC MINERALS LTD.	GEOLOGICAL, AIRBORNE GEOPHYSICAL SURVEYS; DIAMOND DRILLING: HASAGA MINE, HEYSON TWP. AND RED LAKE GOLD SHORE PROPERTY, DOME TWP.
		GEOLOGICAL, GEOPHYSICAL SURVEYS: MCKENZIE ISLAND PROPERTY, DOME TWP.

TABLE 3.2 Continued

<table>
<tr><th>Number on Figure</th><th>Individual or Company</th><th>Activity</th></tr>
<tr><td>36</td><td>LAKE PONASK GOLD CORPORATION</td><td>GEOPHYSICAL SURVEY; DIAMOND DRILLING (10)-1876.3 m: PONASK LAKE MAP SHEET
DIAMOND DRILLING (3)-415.1 m: ANCHICUM BAY MAP SHEET</td></tr>
<tr><td>37</td><td>LAVERTY RED LAKE RESOURCES INC.</td><td>LINE CUTTING; PROSPECTING: HEYSON TWP.</td></tr>
<tr><td>38</td><td>LENCOURT LIMITED</td><td>DIAMOND DRILLING (4)-413 m: TOM GROUP, SATTERLY LAKE MAP SHEET</td></tr>
<tr><td>39</td><td>LUXOR EXPLORATIONS INC.</td><td>GEOPHYSICAL SURVEYS: SLATE BAY PROPERTY, MCDONOUGH TWP.</td></tr>
<tr><td>40</td><td>MACIEJEWSKI, A.</td><td>GEOLOGICAL SURVEY; TRENCHING; MANUAL WORK; MECHANICAL STRIPPING; ASSAYING; LINE CUTTING: BALL TWP.</td></tr>
<tr><td>41</td><td>MCFINLEY RED LAKE MINES LTD.</td><td>MILL TESTING; TAILINGS POND CONSTRUCTION; UNDERGROUND EXPLORATION CONSISTING OF DRIFTING, CROSS CUTTING, RAISING; DIAMOND DRILLING: BATEMAN TWP.</td></tr>
<tr><td>42</td><td>MCNERNEY, W.</td><td>GEOLOGICAL SURVEY; ASSAY ANALYSIS: HEWITT LAKE MAP SHEET</td></tr>
<tr><td>43</td><td>MUTUAL RESOURCES LTD.</td><td>GEOPHYSICAL SURVEYS; TRENCHING; SAMPLING; 35 KM LINE CUTTING; DIAMOND DRILLING (7)-465 m: DIXIE LAKE MAP SHEET</td></tr>
<tr><td>44</td><td>NORAMCO EXPLORATIONS INC.</td><td>GEOLOGICAL, GEOPHYSICAL SURVEYS; LINE CUTTING; PROSPECTING ON 5 PROPERTIES; DIAMOND DRILLING AS FOLLOWS:
<table>
<tr><th>PROPERTY</th><th>LOCATION</th><th>NO. OF HOLES</th><th>TOTAL DRILLED</th></tr>
<tr><td>DEAN CREEK</td><td>BALL TWP</td><td>9</td><td>1,165.0 m</td></tr>
<tr><td>GULLROCK</td><td>BALMER TWP</td><td>6</td><td>986.0 m</td></tr>
<tr><td>BONANZA</td><td>DOME TWP</td><td>51</td><td>7,687.0 m</td></tr>
<tr><td>MCKENZIE ISLAND</td><td>DOME TWP</td><td>3</td><td>607.0 m</td></tr>
<tr><td>SHABUMENI</td><td>GOODALL/HONEYWELL TWPS</td><td>6</td><td>1,012.9 m</td></tr>
<tr><td>SWAIN</td><td>GOODALL/HONEYWELL TWPS</td><td>12</td><td>1,964.2 m</td></tr>
<tr><td>MOSIER</td><td>GOODALL/SKINNER TWPS</td><td>14</td><td>2,275.2 m</td></tr>
<tr><td>BOUZAN</td><td>HEYSON TWP</td><td>11</td><td>2,241.2 m</td></tr>
<tr><td>BERENS RIVER W.</td><td>NORTH TROUT LAKE</td><td>14</td><td>2,016.0 m</td></tr>
<tr><td>BERENS RIVER E.</td><td>SETTING NET LAKE</td><td>20</td><td>3,215.0 m</td></tr>
<tr><td>ZAHAVY</td><td>SETTING NET LAKE</td><td>23</td><td>3,266.0 m</td></tr>
<tr><td></td><td></td><td>169</td><td>26,435.5 m</td></tr>
</table></td></tr>
<tr><td>45</td><td>NORANDA EXPLORATION COMPANY LIMITED</td><td>GEOPHYSICAL SURVEY; DIAMOND DRILLING (8)-952.8 m: MORAN PROPERTY, SLATE LAKE MAP SHEET
AIRBORNE GEOPHYSICAL SURVEY; SOIL AND ROCK SAMPLING: GERRY LAKE AND FREDART LAKE MAP SHEETS
AIRBORNE GEOPHYSICAL SURVEY: KARAS LAKE, BRUCE LAKE MAP SHEETS AND MITCHELL, BOWMAN AND BELANGER TWPS.
AIRBORNE GEOPHYSICAL SURVEY; DIAMOND DRILLING (3)-1200 m: SOUTH OF OTTER LAKE MAP SHEET</td></tr>
<tr><td>46</td><td>OROFINO RESOURCES LIMITED</td><td>MECHANICAL STRIPPING; SAMPLING: RED SUMMIT MINE, TODD TWP.
DIAMOND DRILLING (25)-3485.1 m; GEOPHYSICAL, GEOLOGICAL SURVEYS; GEOCHEMICAL: JACKSON-MANION MINE, DENT TWP.
GEOLOGICAL, GEOPHYSICAL, GEOCHEMICAL SURVEYS: AGNEW TWP., EARNGEY TWP.</td></tr>
<tr><td>47</td><td>PELANGIO-LARDER MINES LIMITED</td><td>GEOPHYSICAL SURVEY: WESLEYAN LAKE MAP SHEET</td></tr>
<tr><td>48</td><td>PENWAY EXPLORERS LTD.</td><td>GEOPHYSICAL SURVEYS: HEYSON TWP.
GEOPHYSICAL SURVEYS; DIAMOND DRILLING (14)-3047.9 m: BATEMAN TWP.</td></tr>
<tr><td>49</td><td>PETROMET RESOURCES LTD.</td><td>GEOLOGICAL, GEOCHEMICAL SURVEYS; ASSAYS: HEWITT LAKE MAP SHEET</td></tr>
<tr><td>50</td><td>PIGEON, L. A.</td><td>GEOPHYSICAL SURVEY: DOME TWP.</td></tr>
<tr><td>51</td><td>PLACER DOME INC.</td><td>GEOLOGICAL, AIRBORNE AND GROUND GEOPHYSICAL SURVEYS; LITHOGEOCHEMICAL SAMPLING: BOWERMAN TWP.
GEOLOGICAL SURVEY; TRENCHING: EARNGEY TWP.
GEOLOGICAL, GEOPHYSICAL SURVEYS; DIAMOND DRILLING (19)-2619.5 m; TRENCHING: CORELESS AND DENT TWPS.
GEOPHYSICAL SURVEY; DIAMOND DRILLING (17)-2743 m: CASUMMIT LAKE AND KEIGAT LAKE MAP SHEETS</td></tr>
<tr><td>52</td><td>RED LAKE BUFFALO RESOURCES LTD.</td><td>DEWATERING; RAMP REHABILIATION AND 77 m RAMP EXTENSION; UNDERGROUND DIAMOND DRILLING 1170 m; SURFACE DIAMOND DRILLING (5)-645.5 m: BUFFALO RED LAKE MINE, HEYSON TWP.
DIAMOND DRILLING (9)-1211.8 m: MADSEN MINE, BAIRD TWP.
GEOPHYSICAL, GEOCHEMICAL SURVEYS: JUMA PROPERTY, DOME TWP.</td></tr>
<tr><td>53</td><td>RED LAKE & SUN VALLEY RESOURCES LTD./ INTERQUEST RESOURCES CORPORATION</td><td>DIAMOND DRILLING (14)-1525 m: FOLLANSBEE PROPERTY, DOME TWP.</td></tr>
<tr><td>54</td><td>RIVARD, O.</td><td>DIAMOND DRILLING (2)-198 m: TODD TWP.</td></tr>
<tr><td>55</td><td>SHANE RESOURCES LTD.</td><td>DIAMOND DRILLING (5)-749 m: BALL AND TODD TWPS.</td></tr>
<tr><td>56</td><td>SHERRIT GORDON MINES LIMITED</td><td>GEOLOGICAL SURVEY; MANUAL STRIPPING; TRENCHING; CHANNEL SAMPLING; DIAMOND DRILLING (5)-530 m: DORION ISLAND PROPERTY, DOME TWP.</td></tr>
<tr><td>57</td><td>SILVERSIDE RESOURCES INC.</td><td>GEOLOGICAL, GEOPHYSICAL SURVEYS: EARNGEY TWP.
GEOLOGICAL SURVEY; SAMPLING: PATRICIA DENT PROPERTY, DENT TWP.</td></tr>
<tr><td>58</td><td>SPINELLI, J./PETERSON, C.</td><td>MECHANICAL STRIPPING: HEYSON AND BYSHE TWPS.</td></tr>
</table>

TABLE 3.2 Continued

Number on Figure	Individual or Company	Activity
59	ST. JUDE RESOURCES LTD.	GEOPHYSICAL SURVEY: EARNGEY TWP.
60	TANQUERAY RESOURCES LTD.	AIRBORNE GEOPHYSICAL SURVEY: WAVELL LAKE, UPPER GOOSE LAKE, BROWNSTONE LAKE MAP SHEETS
61	TECK EXPLORATIONS LTD./HALLEY RESOURCES LTD.	GEOPHYSICAL SURVEY; DIAMOND DRILLING AS FOLLOWS: DEEP (5)-5791 m, SHALLOW (3)-548.6 m: HOWEY MINE, HEYSON TWP.
62	UMEX INC.	AIRBORNE GEOPHYSICAL SURVEY: BROWNSTONE LAKE, WAVELL LAKE AND CASUMMIT LAKE MAP SHEETS
63	UNITED REEF PETROLEUMS LTD.	DIAMOND DRILLING (22)-6170.4 m: DAM CREEK PROPERTY, BAIRD TWP.
		GEOPHYSICAL SURVEYS; DIAMOND DRILLING (25)-5920.5 m; 60 KM LINE CUTTING: AIKEN-RUSSETT PROPERTY, BAIRD TWP.
64	WESTERN CANADIAN MINING CORPORATION/ VENTUREX INTERNATIONAL MINING CORPORATION	GEOPHYSICAL SURVEYS; DIAMOND DRILLING (3)-304.8 m: BLANCHARD PROPERTY, BALL TWP.
65	WESTMIN RESOURCES LTD.	PROSPECTING; SAMPLING: STULL LAKE MAP SHEET
66	WHEELWRIGHT EXPLORATIONS LTD.	GEOPHYSICAL SURVEYS: HEYSON TWP.

est (A. Murdy, Regional Manager, Noramco Explorations Inc., personal communication, 1988).

Chevron Minerals Ltd.

Chevron Minerals carried out ground geophysical surveys, power stripping, and diamond drilling on the Skookum Bay and My–Ritt properties in Dome and Heyson townships.

Charlarmar Resources Inc.

Charlarmar Resources conducted mechanical stripping on three properties in Heyson, Byshe, and Bateman townships.

Goldquest Exploration Inc.

Goldquest Exploration holds a number of properties in the Red Lake greenstone belt, and several of these are strategically located relative to current and past producing mines. In addition to milling ore from the Lake Rowan Property at the Arthur W. White Mill, Goldquest continued drilling exploration of four properties including the Redcon, the Abino, the Inore, and the Duchesne groups. Both the Redcon and Lake Rowan properties had additional geological mapping done. The two open raises and manway at the Lake Rowan Mine were capped with concrete. Goldquest is presently having all ground magnetic data for their Lake Rowan Property and those properties around East Bay reprocessed for reinterpretation of geology and structures.

The Abino decline continued to operate as an underground hardrock miner training facility.

Penway Explorers Ltd.

Penway Explorers carried out a drilling program on the optioned Crawford Property in the East Bay area of Red Lake. This drilling was designed to test VLF–EM and induced polarization (IP) anomalies. Nine holes drilled on geophysical targets encountered several zones of carbonate–altered, mafic volcanics and iron formation. Mineralization included pyrite, pyrrhotite, sphalerite, galena, and arsenopyrite. Gold values generally ranged from 0.01 to 0.08 ounce per ton over 0.6 m widths. One hole reportedly included four sections ranging from 0.10 to 0.52 ounce gold per ton over 0.3 m. Drilling targets were along the on–strike extension of ore mineralization at the McFinley Mine, 700 m to the southeast. Penway also carried out magnetic and VLF–EM surveys on their 73–claim group in Heyson Township (A.B. Whitelaw, President, Penway Explorers Ltd., personal communication, 1988)

Biron Bay Resources Ltd.

Adjoining Penway's property in Bateman Township, Biron Bay Resources flew an airborne magnetic and EM survey on their claims. Although completed in 1987, this work was reported for assessment credits in 1988.

Lac Minerals Ltd.

Lac Minerals pursued additional gold mineralization in past producing mines at the Hasaga Mine in Heyson Township, the Red Lake Gold Shore Mine in Dome Township, and the McKenzie Red Lake Gold Mine. Exploration on the Hasaga Mine included geological mapping, line cutting, geophysical surveys, and diamond drilling. Drill targets included a deep drilling program under the 'C' block which was outlined below the 549 m level and has published reserves of 200 203 tons of ore at 0.192 ounce gold per ton (Ferguson 1968).

At the Red Lake Gold Shore Mine, Lac Minerals Ltd. carried out geophysical and geological surveys as well as diamond drilling.

Exploration of the McKenzie Red Lake Gold Shore Mine included IP surveys and geological mapping.

Red Lake Buffalo Resources Ltd.

On the Buffalo Property, Red Lake Buffalo Resources dewatered the underground workings and rehabilitated the ramp. The ramp was extended an additional 77 m. Diamond drilling included 1170 m underground, and a surface program of five holes totalling 646 m aimed at identifying additional zones of mineralization. Underground activities ceased on March 1, 1988. The ramp and shaft were sealed and the workings allowed to flood.

Red Lake Buffalo Resources acquired the Madsen Mine and the Starratt–Olsen Mine, both in Baird Township. At the Madsen Mine, the company carried out a drilling program to test ore remaining in the upper levels of the mine. No work was carried out at the Starratt–Olsen Mine.

On the Juma Property, in Dome Township, a property largely under the waters of Red Lake, a winter program of geophysical surveys and lake bottom geochemical sampling through the ice was carried out by Red Lake Buffalo Resources (N. Gow, Geological Consultant, Red Lake Buffalo Resources Ltd., personal communication, 1988)

Red Lake & Sun Valley Resources Ltd.—Interquest Resources Corporation

Red Lake & Sun Valley Resources, in a joint venture with Interquest Resources, continued drilling on the Follansbee Property in Dome Township. This property is located immediately south of the Cochenour Mine. A drilling program in 1987 encountered gold mineralization of 0.08 ounce per ton over 18 m including one section running 0.19 ounce gold per ton over 6 m (The Northern Miner, September 19, 1988).

Sherritt Gordon Mines Ltd.

Also in Dome Township, Sherritt Gordon Mines conducted an exploration program on the Dorion Island Property. Work included manual stripping, trenching, channel sampling, and diamond drilling. The exploration effort was directed towards an auriferous sedimentary unit exposed on Dorion Island.

United Reef Petroleums Ltd.

United Reef Petroleums continued exploring two properties in Baird Township. These were the Aiken–Russett Property, and the Dam Creek Property. Combined drilling on the properties totalled more than 12 000 m in 47 holes.

Mount Jamie Mines Ltd.

In the western end of Red Lake, Mount Jamie Mines carried out a surface geophysical program and did limited underground drifting and crosscutting development work in preparation for bulk sampling earlier in the year. However, bulk sampling was suspended and the mine workings were allowed to flood. The mine is on a care–and–maintenance status at the present time.

O. Rivard, R. Gibson

Also, in the western end of the Red Lake greenstone belt, O'Brien Rivard and Robert Gibson carried out small drilling programs on their respective properties in Todd Township.

Shane Resources Ltd.

Shane Resources holds 52 claims in Ball and Todd townships which cover the West Red Lake Property. This prospect includes a shaft and limited underground work performed in 1934 and 1935. The company has been carrying out exploration work since 1986 and did limited diamond drilling.

BHP–Utah Mines Ltd.

BHP–Utah Mines Ltd. mounted a detailed mapping and lithogeochemical sampling program on their claims in Todd and Fairlie townships.

BIRCH–CONFEDERATION LAKES GREENSTONE BELT

Gold Crest Minerals Ltd.

The Hudson Patricia Mine in Dent Township was a former gold producer in the Birch–Confederation greenstone belt. The mine produced 1857 ounces of gold and 305 ounces of silver from 11 228 tons of ore between 1936 and 1937. In 1988, Gold Crest Minerals carried out geophysical surveys to further evaluate the property.

Silversides Resources Inc.

Immediately south of the Hudson Patricia Property, Silversides Resources holds a block of claims in Dent Township. The claim group includes the Patricia Dent and Rouillard gold occurrences.

On the Patricia Dent Occurrence, two shafts, each to a depth of 15 m, had been sunk by 1929. Extensive trenching had also been carried out on numerous quartz veins and shears on the property. Silverside Resources Inc. carried out geological and geophysical surveys, as well as trench rehabiliation and sampling. During a property visit by the author to the north shaft area, several samples of mineralization were collected from the dump pile. Assays on these samples were 0.34, 0.94, and 7.58 ounces gold per ton. The highest assayed rock carried visible gold. Other mineralization included pyrite, sphalerite, chalcopyrite, and rare galena.

Algonquin Minerals Inc.—Nexus Resource Corporation

Also in Dent Township, Algonquin Minerals and Nexus Resource commenced a diamond drilling program on the Ontario Woman Lake Occurrence.

Canadian Patricia Exploration Ltd.

Canadian Patricia Exploration conducted geological and geophysical surveys on its Skinner Township property, as well as stripping and trenching.

Golden Hat Resources Inc.

Golden Hat Resources diamond drilled the Dunkin Property in Skinner Township. This gold occurrence includes a shaft to a depth of 83 m with development work on two levels totalling 215 m. The Golden Hat Resources drilling program was aimed at further defining several auriferous quartz veins that were channel sampled on surface. Drill results from the program were disappointing (The Northern Miner, March 7, 1988).

Orofino Resources Ltd.

Orofino Resources continued evaluating the former producer, Jackson Manion Mine, in Dent Township. An 18-hole drilling program on the property returned several ore-grade gold intersections over mineable widths (The Northern Miner, April 18, 1988).

Placer Dome Inc.

Placer Dome flew an airborne magnetic and EM survey over their large claim group in Bowerman Township. This survey was followed up by ground geophysical surveys, geological mapping, and lithogeochemical sampling. Detailed geological mapping and trenching was performed by the company in Earngey Township. The company also did mapping, trenching, geophysical surveys, and diamond drilling on its Corless-Dent Township property. The drilling program was directed towards several well documented gold occurrences near Surprise Lake.

Placer Dome also drilled two of its claim groups in the Birch Lake area. These were the Johnson Island claim group and the Keigat Lake Property. A VLF-EM survey was carried out over the company's Angela Lake Property.

Noranda Exploration Company, Limited

Noranda Exploration flew a 1500 line-kilometre airborne survey over the Cycle III metavolcanics extending from the South Bay Mine in Dent Township to Bruce Lake. This survey was directed towards base-metal exploration. Several properties in the belt were geologically mapped and lithogeochemically sampled. The company drilled their claims in the Slate Lake area and their South of Otter Lake Property. Also, an 8-hole drilling program tested gold mineralization on the Moran Property on the southern side of Richardson Lake.

Noramco Explorations Inc.

Noramco Explorations worked three properties in the Birch-Confederation lakes area. These properties were the Swain Lake group which consists of 157 claims, the Shabumeni Lake group of 144 claims, and the Mosier Lake group of 248 claims. All three properties were covered by ground magnetic and VLF-EM surveys. The Swain Lake group and Shabumeni Lake group also received limited IP surveys. Diamond drilling totalled 1964 m in 12 holes on the Swain Lake group, 1013 m in 6 holes on the Shabumeni Lake group, and 2275 m in 14 holes on the Mosier Lake claim group.

BHP-Utah Mines Ltd.

BHP-Utah Mines Ltd. conducted a reconnaissance mapping program in the Slate Lake area. The program included geological mapping and lithogeochemical sampling for both gold and base-metal mineralization.

Canadian Eagle Exploration Inc.

Canadian Eagle Exploration flew an airborne magnetic and EM survey over its Shabumeni Lake property.

Falconbridge Limited

Falconbridge conducted geological mapping and lithogeochemical sampling on the Hodgson option property in the Shabumeni Lake area. The program was directed towards precious and base-metal mineralization.

Buffalo Resources Ltd.

Buffalo Resources Ltd. carried out a small diamond drilling program as follow up to an IP survey conducted the previous year in the Curie Lake area.

Lencourt Ltd.

Lencourt conducted a small drilling program on the Tom Group in Satterly Lake.

Bond Gold Canada Inc.

Bond Gold Canada, in a joint venture program with Gabbs Resources Ltd. and Nexus Resource Corporation, drilled the Penson Lake Property in Birch Lake.

Bond Gold Canada also did additional drilling on their Horseshoe Island Property and McIntyre Bay properties.

Golden Terrace Ltd.

Golden Terrace continued drilling on the Kostynuk Mine, Richardson Lake area. A total of 5543 m was drilled this year. Golden Terrace has drilled on this property a total of 9658 m of which, 7443 m tested mineralization in the shaft area, and the remainder on four other mineralized zones.

Gold Fields Canadian Mining Ltd.

Gold Fields Canadian Mining continued an extensive diamond drilling program on their Springpole Lake Property. This is the third year Gold Fields has carried out work on the property. Over 50 percent of the total drilling to date was completed in the past year.

Gold Fields Canadian Mining also carried out limited diamond drilling, trenching, sampling, and humus geochemical sampling on outlying properties in the Birch Lake area.

Umex Inc.

A total of 449 line–kilometres of airborne magnetic and EM surveys was flow by UMEX over their 229 claims in the Brownstone Lake area, north of Birch Lake.

NORTHERN GREENSTONE BELTS

Lingman Lake Belt

Agassiz Resources Ltd. continued a major exploration effort on the Twin Gold Mines Ltd. property in Lingman Lake (*see* Advanced Exploration and Development Section for more details).

Stull Lake Belt

In the Stull Lake greentstone belt, Westmin Resources Ltd. carried out prospecting and sampling on their claim group covering previously documented gold occurrences. The claim group straddles the Ontario–Manitoba border. Noranda Exploration Inc. acquired claims in the Stull Lake area.

Sachigo River Belt

Canadian Nickel Co. Ltd. carried out an 8–hole diamond drilling program totalling 1011 m on the Sachigo River Mine Property. This former gold producer is Ontario's most northerly mine. Gold production between 1938 and 1941 totalled 52 560 ounces from 46 457 tons of ore milled for a recovered grade of 1.15 ounce gold per ton.

Sandy Lake Belt

On Sandy Lake, Goldeye Explorations Ltd. flew an airborne geophysical survey and did follow–up diamond drilling and geological mapping.

Muskrat Dam Lake Belt

CAMECO (A Canadian Mining and Energy Corporation) (formerly Eldor Resources Ltd.) continued diamond drilling their Kippey Property on the eastern side of the Windigo River in the Muskrat Dam Lake greenstone belt. Drill results from a 1987 exploration program include an intersection of 4.3 m of 0.25 ounce gold per ton (The Northern Miner, January 4, 1988). Geophysical surveys and additional diamond drilling in five holes totalling 586 m was completed this year.

Favourable Lake Belt

In the Favourable Lake greenstone belt, Noramco Explorations Inc. carried out detailed geological mapping and surface diamond drilling (*see* Advanced Exploration and Development—Noramco Exploration Inc.–Berens River Mine).

Noramco Explorations Inc. also diamond drilled 20 holes totalling 3215 m on its Berens River East Property of 342 claims adjoining the Berens River Mine Property.

North Spirit Lake Belt

Work performed by Petromet Resources Ltd. on their Pontoon Bay claim group in North Spirit Lake included geological and geochemical surveys.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Red Lake office underwent major personnel changes this year. Brian Atkinson, former Staff Geologist, was appointed the Red Lake Resident Geologist after Moe Lavigne left the Red Lake office to become the Thunder Bay Resident Geologist. Lynn Kosloski replaced Carol Kreuger as Secretary. Contract staff during the year included Janet Smith, Secretary; Gail Soberman, Geological Assistant; and Cara Green and Gary Gazankas, Field Assistants.

Office staff participated in the Northwestern Region Geoscience Seminar in Thunder Bay and presented a poster on exploration activity in the Red Lake District.

The Red Lake Office hosted a Regional Geoscience Research Seminar which included the first industry participation in the form of core–shack displays. The Red Lake open house included a historical talk on Red Lake given by local prospector Charlie Peterson.

Numerous field trips to the Red Lake geology were given to mineral exploration company geologists, visiting academics from around the globe, and consulting geologists.

Office staff attended the Prospectors and Developers Association Convention in Toronto, and participated in field excursions and sampling expeditions with Ontario Geological Survey personnel throughout the Red Lake District.

Moe Lavigne participated in the Gold '88 Convention held in Melbourne, Australia, and presented talks and a poster on Red Lake geology.

Brian Atkinson commenced re–mapping Heyson Township geology at a scale of 1:10 560.

A number of properties undergoing exploration were visited during the year, as were inactive mineral occurrences throughout the district. Several of these are descibed below.

PROPERTY VISITS

ALCON OCCURRENCE, BIRCH LAKE AREA

The Alcon Occurrence is located 1 km north of Mink Lake on the northwest side of Birch Lake. It is approximately 67 km northeast of Red Lake. The ground is currently held by Esso Resources Canada Ltd. as part of a large group of claims the company holds in the area. The first record of staking of the property was by John Hatch, 1931. Alcon Exploration and Mining Syndicate Ltd. acquired a group of claims covering the occurrence, and carried out limited exploration in 1959. The claims have been worked by several interests since that time and a limited amount of diamond drilling was performed. Esso Resources Canada Ltd. acquired the ground in 1987 and carried out exploration including geological, geophysical, and geochemical surveys, as well as rehabilitating old trenches and doing additional stripping.

The Alcon Occurrence is underlain by north–facing felsic to intermediate rocks on the south, and mafic metavolcanic rocks on the north, with south facing pillows. A pronounced regional northwest–trending dextral shear hosts numerous gold occurrences and the Alcon occurrence is located on this major structure. Lithologies exposed by outcrop stripping consist of intermediate pyroclastic breccias, tuffs, and lapilli tuffs overlying thinly bedded mudstones. A semi–concordant dike of diorite composition, 1.5 m in width, intrudes the volcanic sequence parallel to foliation. All lithological units are intruded by narrow quartz veins which show variable degrees of deformation and pyrite mineralization. The quartz veins are generally under 20 cm in width, but where folded and boundinaged, thicken considerly. Alteration of the host rocks includes sericitization and pervasive iron carbonatization in the vinicity of the trenches.

ALCOURT OCCURRENCE, FAIRLIE TOWNSHIP

The Alcourt Occurrence is located in central Fairlie Township on the northern side of Red Lake. Located approximately 12 km northwest of the Town of Red Lake, access to the property is via the Pine Ridge Road which passes within 1 km of the occurrence.

The Alcourt Occurrence was first held by Monetary Metals Ltd. in 1934. Subsequent to that time, a number of individuals and companies have held the property and (or) performed exploration on it. A 1981 report on the property, by Sherritt Gordon Mines Ltd., indicates possible reserves in the No. 1 vein are 17 000 t grading 0.24 ounce gold per ton.

The Alcourt Occurrence consists of several sulphide–bearing, auriferous quartz veins hosted by a small gabbroic stock. The stock intrudes a sequence of north–dipping intermediate volcanic rocks, and clastic sediments consisting of argillites, wackes, and clast–supported polymictic conglomerates. The gabbro stock has intruded the country rocks in the vicinity of a high–strain zone which parallels the contact of the Hammell Lake Batholith, 1.5 km to the north. The gabbro is a roughly elliptical body with maximum dimensions of 150 m by 350 m. It consists of a medium–grained, homogenous, melanocratic gabbro in which augite is largely altered to hornblende.

Three significant quartz veins occur within the gabbro and these have been exposed along strike by blasting and trenching. The main vein, or No. 1 vein strikes 344° and dips vertically, varies in width from several centimetres to a maximum of 1 m, and attains a strike length of 120 m. The vein has several left–handed offsets with a combined displacement of 10 m. The vein is variably mineralized with pyrite, chalcopyrite, sphalerite, galena, and native copper. Grab samples from the vein yielded assays up to 3.7 ounce gold per ton and 1.2 ounce silver per ton.

A second vein, parallel to the No. 1 vein, has been exposed 55 m east of the main vein. The No. 2 vein has a strike length of 65 m and varies in width from 5 to 30 cm. The No. 2 vein extends 10 m north of the gabbro contact into the enclosing conglomerates. Mineralization in this vein is similar to the No. 1 vein.

The No. 3 vein crops out near the south end of the No. 1 vein. This vein trends northeast and is mineralized with minor pyrite and visible gold. The exposed strike length of this vein is 25 m with a maximum width of 30 cm. Wall rock adjacent to the No. 3 vein is moderately sheared and pyritized.

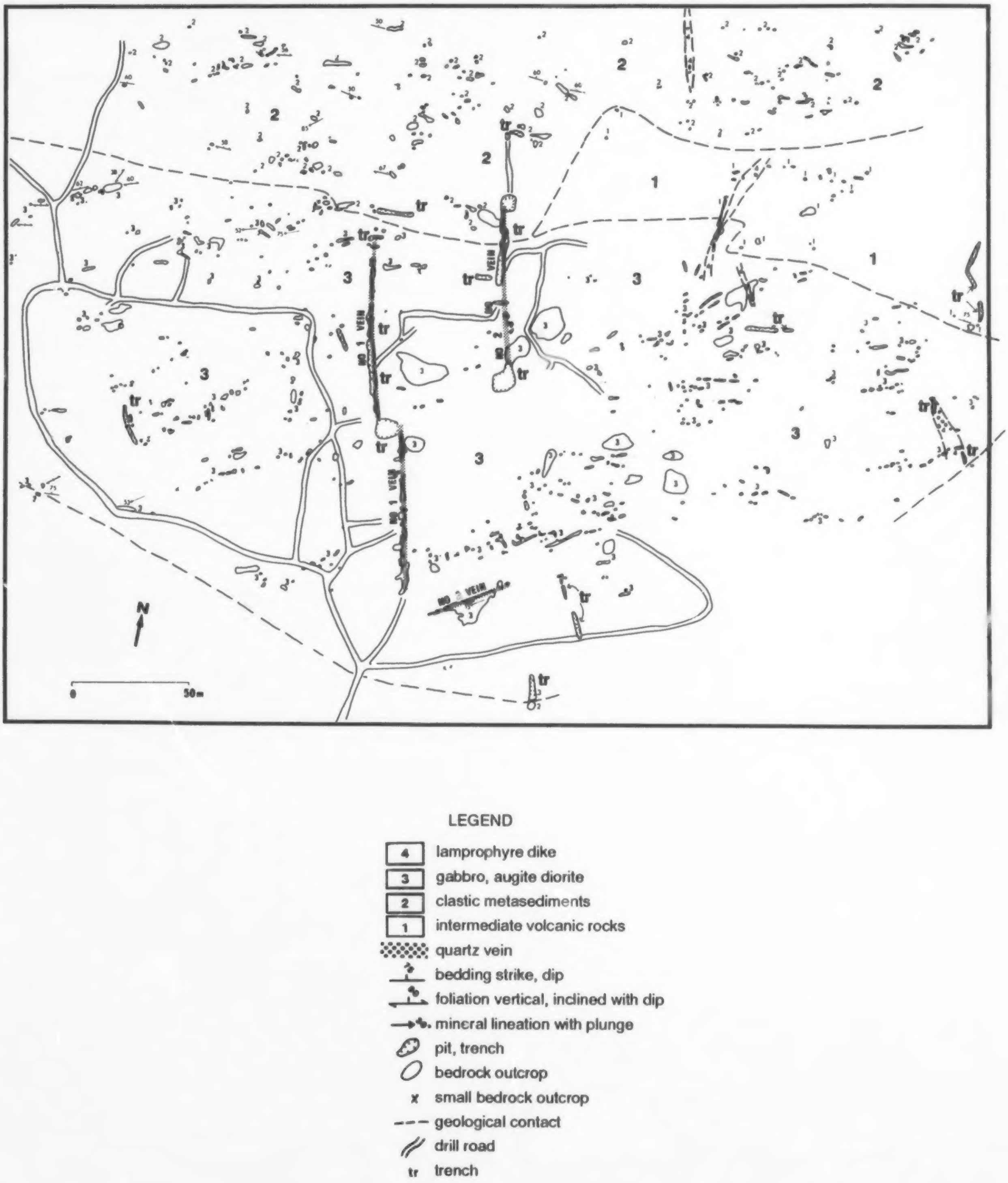
Detailed mapping at a scale of 1:500 by the author, (Figure 3.2) indicates the entire gabbro stock has undergone a north–south compression which induced brittle failure of the stock. Tension gashes trending approximately north, opened and were subsequently mineralized with quartz and sulphides, (i.e., No. 1 and 2 veins). Deformation resulted in the development of a conjugate set of shear fractures symmetrical about the principle north–south stress orientation. These fractures are expressed as small narrow shears and joint sets which trend 045° and 310°. The 045° set predominate on the Alcourt Occurrence and it is within this set that the No. 3 vein occurs.

From a detailed examination of the gabbro stock, it can be seen that gold mineralization occurs both in north–trending tension gashes and the dominant sinistral shears which trend 045°. These vein orientations may prove important in similar geological environments hosting auriferous quartz veins throughout the Red Lake greenstone belt.

HORNBY LAKE OCCURRENCES

The Hornby Lake greenstone belt is located 150 km north of Red Lake in the Berens River Subprovince. A brief reconnaissance of the northern part of the belt was made during the 1988 field season. Several of the known mineral occurrences were investigated, and a suite of representative lithologies was collected.

The Hornby Lake greenstone belt consists dominantly of pillowed to massive mafic to komatiitic flows with subordinate intrusions of mafic to ultramafic composition. Minor lithologies include wacke sediments, intermediate metavolcanics, and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3 gabbro, augite diorite
2 clastic metasediments
1 intermediate volcanic rocks
quartz vein
bedding strike, dip
foliation vertical, inclined with dip
mineral lineation with plunge
pit, trench
bedrock outcrop
x small bedrock outcrop
geological contact
drill road
tr trench

Figure 3.2. *Geological map of the Alcourt Property—Fairlie Twp.*

sulphide–facies iron formation. The Hornby Lake greenstone belt is enclosed by batholiths of tonalitic to granodioritic composition. Both the supracrustals and enclosing batholiths have been affected by a regional deformation that has produced a strong north–south–trending foliation.

The observed mineral occurrences are situated on the northwestern and southern shores of Fardum Lake (local name), 0.5 km east of the north end of Hornby Lake.

Asbestos Corporation carried out geological and geochemical surveys, as well as trenching and pack–sack drilling on the showings in 1968. The showing on the northwest side of the lake is exposed in a bedrock trench blasted into a low, rock cliff, and measures 3 m by 1 m by 1 m. This trench exposes a 1 to 2 m wide sulphide facies iron formation consisting of thinly banded pyrrhotite with minor pyrite and chalcopyrite within thin, sulphide–poor, graphitic horizons. The sulphide bands are less than 1 cm thick and show fold deformation. The iron formation trends north and occurs between mafic metavolcanics on the west and a medium–grained gabbro to the east. Where the gabbroic unit crops out on Fardum Lake, thin, short veinlets of asbestos mineralization occur. Eastwards, the gabbro is in contact with garnetiferous, amphibolitized metawackes. Garnet in the metawackes occurs as mineral aggregates showing elongation parallel to foliation which trends 354° and dips 62° east. A coarse, crystalline, melanocratic ultramafic rock crops out east of the metasedimentary unit. The ultramafic rock is variably altered to serpentine, talc, and magnetite.

Several character samples collected from the trenched mineralized zone yielded 8 to 18 ppb gold, 54 to 590 ppm copper, and 16 to 156 ppm nickel. A sample of serpentinized ultramafic rock yielded <2 ppb gold, 84 ppm copper, and 2000 ppm nickel.

On the south side of Fardum Lake, a single bedrock trench measuring 1.5 m by 1 m by 1 m has been excavated in rusty weathering ferruginous chert enclosed by strongly sheared mafic metavolcanics. Minor chalcopyrite was observed associated with pyrrhotite in the ferruginous chert. The mineralized zone trends 020°, dips 80° east, and is 1 m in width.

A 4 m wide quartz–feldspar porphyry dike crops out on the south shore of Fardum Lake in the vinicity of the south trench. The dike has a weakly developed foliation trending 080°. Eastwards from the dike, thinly banded mafic metavolcanics trend 030° and dip 56° east. Garnet porphyroblasts occur as discreet bands within the mafic volcanics. Samples from the south showing assayed 6 to 11 ppb gold, 256 to 480 ppm copper, 530 to 755 ppm zinc, and 102 to 324 ppm nickel.

Asbestos Corporation reports the sulphide–bearing zone varies from 0.3 m up to 45 m in width, and has a strike length over 5 km. Low values in copper and nickel are reported by the company, but the association of the sulphide zone with ultramafic rocks warrants further investigation for copper–nickel mineralization.

QUARTZ VEINS IN GRANITOID ROCKS

During the course of mapping Heyson Township, a major quartz vein complex was identified 200 m south of the southwestern corner of Heyson Township. The silicified zone occurs 400 m north of Roger Lake in the west end of the Gullrock Lake Batholith. The Roger Lake vein complex consists of multiple generations of anastomosing quartz veins and wall rock silicification over an exposed strike length of 200 m and a 30 m width. The Roger Lake vein complex trends northwest and very rarely carries pyrite. It occurs on a major structural break which can be identified on airborne magnetic surveys covering the Red Lake greenstone belt.

A second major quartz vein complex occurs in the Killala–Baird Batholith, 14.5 km northwest of the Roger Lake vein complex. This vein complex is situated 2.2 km west of Parker Lake in northeast Killala Township, and was previously identified by Horwood (1945, Map 49a). The Killala vein complex has a strike length of 200 m with a maximum width of 45 m. The Killala vein complex occurs on the same structure as the Roger Lake vein complex. It consists of multiple generations of quartz veining and wall rock silicification, accompanied only rarely by pyrite mineralization.

Thirteen samples were collected from the Killala vein complex and three from the Roger Lake vein complex. One sample from the Killala vein complex assayed 17 ppb gold. All other samples assayed less than 2 ppb gold.

Based on geochronological constraints on the timing of gold mineralization in the Red Lake District, combined with the negative results of limited sampling, the likelihood of the Roger Lake and Killala vein complexes hosting economic gold mineralization seems remote. However, gold occurrences have been noted in other external batholiths; several have been identified in the vicinity of Douglas Lake, Mulcahy Township, at the western margin of the Red Lake greenstone belt. Hence, the major structure hosting the Killala and Roger Lake vein complexes should be prospected along its entirety for other silicified zones and gold mineralization. The Killala vein complex has been evaluated for its industrial mineral potential (landscaping stone), but due to a large component of wall rock contained within, was considered uneconomic as an industrial mineral source. The Roger Lake vein complex also has a significant deleterious component of wall rock. However, the structure on which these vein complexes occur may contain more massive zones of quartz veining with industrial mineral potential.

TABLE 3.3. SUMMARY OF CORE FROM THE RED LAKE RESIDENT GEOLOGIST'S DISTRICT IN THE CORE LIBRARY, KENORA.

Area	NTS	Company	# Holes
Balmer Township	52N/04 SE	Eldor Resources Ltd.	3
	52N/04 SW	Golden Exploration & Development	3
	52N/04 SE	Granges Exploration Ltd.	6
	52N/04 SE	Gunner Gold Inc.	2
Bateman Township	52N/04 NE	Penway Explorers Ltd.	6
Bruce Lake	52K/14 SW	Griffith Mine	5
Buckett Lake	52C/10 SW	Rockspan Resources	4
Dome Township	52N/04 SW	Sherritt Gordon Mines Ltd.	1
Fairlie Township	52N/04 SW	Minorex Ltd.	1
	52N/04 SW	Selco Mining Corp. Ltd.	1
	52N/04 SW	Sherritt Gordon Mines Ltd.	1
Gerry Lake	52K/14 NE	Noranda Exploration Co. Ltd.	1
Grist Lake	53C/04 NW,NE	Cominco Ltd.	3
Heyson Township	52N/04 SW	Selco Mining Corp. Ltd.	1
Mitchell Township	52N/02 SE	St. Joseph Exploration Ltd.	1
South of Otter Lake	52K/14 NW	Selco Mining Corp. Ltd.	4

CORE STORAGE PROGRAM

The Drill Core Library facilities for the Red Lake Resident Geologist's District are provided by the Drill Core Library in Kenora. Core collected from the Red Lake District between December 1, 1987 and November 20, 1988 totalled 5352.6 m. Core stored consists of entire drillholes from both exploration and mine development drilling, incomplete holes recovered from old drill sites, and short samples of core submitted for credit under Section 77(6) of the Mining Act (RSO 1980). Some of the core has been re-logged and sampled by drill core library staff.

At the time of writing, the library held, from Red Lake, 5414.2 m of completely catalogued core stored inside the building and 2592.0 m in secure outdoor storage.

Core in outdoor storage consists of excess core from several drill projects that were collected in their entirety, and core that has been culled from the system after some holes were re-logged and reduced. This core is available for examination at the request of clients.

Use of the core library by industry and government increased over 1987. A total of 109 visits were made by industry personnel and 44 were made by government personnel (both provincial and federal). Many of the visits by industry personnel to examine core lasted several days. A total of 83.5 man-days were spent by industry geologists examining and logging drill core.

Much of the library's recent core from the Red Lake District is from recent gold exploration; much of it collected from the more remote areas north and east of Red Lake, and from some of the old mines. Most of the core from the Red Lake Mining Division comes from gold exploration projects in the immediate vicinity of Red Lake. Notable exceptions to this are the Griffith Mine core, and core from a group of holes drilled by Selco Mining corporation Limited, related to massive-sulphide occurrences west of the past producing South Bay base-metal mine. A complete catalogue listing of non-confidential core holdings may be obtained by contacting the Kenora core library or the Red Lake Resident Geologist.

Core from a total of 46 drillholes in the Red Lake District is in the main part of the collection, with another 19 holes in outdoor storage. In addition, core from several deposits is stored in Red Lake, awaiting complete documentation before it is moved to Kenora.

Table 3.3 summarizes the core in the collection.

The Griffith Mine core consists of sections through the north and south pits, and represents all the lithologies present in the ore body and host rock. This is the only core remaining from this mine.

Major base-metal exploration projects in the Confederation Lake area in the late 1960s led to the discovery of the South Bay Mine. While no core from the mine is in the core library collection, core from three base-metal properties to the west of the mine, which were drilled by Selco Mining Corp., is available for examination.

The area north of Red Lake has been explored for gold and silver, and to a lesser extent for base metals. Core from three holes drilled by Cominco Ltd. at McInnes Lake, in 1979, indicates a gold-base-metal occurrence. Core drilled in 1986 at North Spirit Lake was recovered and incorporated into the collection. Further core recoveries from the area north and east of Red Lake are planned for 1989.

RECOMMENDATIONS FOR EXPLORATION

The Flat Lake–Howey Bay Deformation Zone is a well documented, major structure in the Red Lake greenstone belt (Durocher and Hugon 1983). This structure hosts a number of past producing gold mines: the Starratt–Olsen, Madsen, Buffalo, Howey, and Hasaga mines. Although the structure has received much attention, exploration must probe deeper along this zone to test for deep gold mineralization.

Many of the properties in the Red Lake belt are receiving exploration attention for gold mineralization. Areas of geological interest south of Red Lake include the wide belt of predominantly metavolcanic rocks north of the Sydney Lake cataclastic zone. This belt of rocks extends eastward from the Dixie Lake area and is host to several gold and base–metal occurrences. The area has historically received only limited exploration, partly due to overburden cover.

Recent prospecting has identified new mineral occurrences and more should be sought. The current trend in exploration is to locate outcrops by power stripping of overburden, a technique that should be applied in the above described area. Numerous logging roads will facilitate prospecting in this terrain. Being the stratigraphic equivalent of the South Bay Mine massive sulphide deposit, the felsic rocks in this part of the greenstone belt have high potential for hosting additional massive sulphide mineralization.

During a brief reconnaissance of the Hornby Lake belt, several samples of sulphide mineralization and ultramafic rocks with anomalous copper–nickel mineralization were collected. The Hornby Lake greenstone belt, particularily in the vicinity of a north–trending sulphide mineralization zone east of the lake, should be explored for copper–nickel mineralization (*refer* to Property Visits–Hornby Lake Occurrences).

Lastly, a major northwest–trending structure cutting the Killala–Baird Batholith is host to several large quartz vein complexes. This structure should be explored for additional zones of silicification, gold mineralization, and quartz as an industrial mineral source (*refer* to Property Visits–Quartz Veins in Granitoid Rocks)

ONTARIO GEOLOGICAL SURVEY ACTIVITES

P.C. Thurston and A.L. Cortis continued reconnaissance mapping of greenstone belts in northwestern Ontario. Particular attention focused on Sandy Lake where Cortis continued work on research for a MSc Thesis at the University of Manitoba.

G.M. Stott and I.A. Osmani did a reconnaissance geological survey in granitoid terrains throughout the Red Lake District as part of the revision of the Province of Ontario geological map.

H.R. Williams conducted geological investigations to delineate the boundary between the Uchi and English River subprovinces in the Slate Lake–Whitemud Lake area.

D. Stone commenced a multi–year mapping project of the Berens River Subprovince.

RESEARCH BY OTHER AGENCIES

B. Gulson of Sirotope, Australia, continued lead istope analysis of mineralized samples from the Red Lake greenstone belt.

The petrology of the Springpole Lake Carbonatite Complex was investigated by N.A. Duke, K.M. Barron, and R.W. Hodder of the University of Western Ontario.

SELECTED REFERENCES AND RECENT PUBLICATIONS

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4. Sioux Lookout Resident Geologist's District—1988

D.A. Janes[1], G.W. Seim[2], and C.C. Storey[3]

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[2]Staff Geologist, Ministry of Northern Development and Mines, Sioux Lookout.

[3]Drill Core Library Geologist, Ministry of Northern Development and Mines, Kenora.

INTRODUCTION

The Sioux Lookout Office is presently staffed by D.A. Janes, Resident Geologist and G.W. Seim, Staff Geologist. M. Roy is the Geological Secretary and C. Proctor is the Geological Data Technician.

R. Spooner was the Sioux Lookout Mining Recorder for most of the year, but has recently transferred to Thunder Bay. R. Majcher, the Red Lake Mining Recorder, will transfer to Sioux Lookout in the near future. D. Cosco is the Recording Office Clerk and S. Keemash is the Assistant Recording Office Clerk. P. Glover is the Claims Inspector for the Patricia Mining Division.

C. Bath acted as field assistant for the Resident Geologist during the summer months. M. Roy worked as a draftsperson and technician in the Resident Geologist's Office. J. Lacosse is employed as a Clerk Typist in the Mining Recorder's Office and R. Kemp assists the Mining Claims Inspector.

A five-year trend of high levels of claim staking, mining exploration, and assessment work submitted, continued in 1988. Table 4.2 is a summary of claim staking and assessment credit received for 1988 and the recent past in the Patricia Mining Division. While claim staking is down from the record levels of 1987, it remains above the ten-year average experienced prior to 1984. Other indices of activity such as diamond drilling, geological and geophysical surveys, and assessment work in general are at lower levels than those reported in 1987, but remain well above ten-year averages. The number of active mining claims remains close to the peak of 19 000 set in 1987, but should slowly decrease over the next few years if present trends continue.

Mineral exploration activity in the Sioux Lookout District continues the trend started in 1981, with gold exploration accounting for more than 80 percent of exploration activity. However, the number of companies and individual prospectors researching base-metal and platinum group metal properties has increased recently. There has been some interest shown in the strategic metals, such as tantalum and gallium, which reflects the improved prices for these metals.

Exploration activity is largely centred in the Central Uchi and North Caribou belts and is at a reduced level when compared to 1987. Table 4.1 lists reported output of many of the active exploration programs. Many advanced properties are at a state where the claim holders are negotiating for additional funding to conduct expanded exploration or development programs. Until the conditions for financing exploration and development projects in Ontario are finalized, the level of exploration activity will be reduced from that experienced in 1987.

The Ontario Geological Survey continued mapping in the Patricia Mining Division in 1988. Four parties spent part of the field season within the Sioux Lookout District. L. Chorlton extended her work in the Dinorwic area to the east and west of her study area (Chorlton 1988). F.W. Breaks spent some time on granite studies, mainly in the English River belt. Several Ontario Geological Survey parties conducted studies on the border relationships between the English River gneissic belt and the Wabigoon volcanic belt.

The Mattabi Mine exhausted its ore reserves and shut down in September 1988. The decision to cease operations was hastened by several weeks of heavy rains which flooded the lower working levels. Production continues at the Lyon Lake Mine (Noranda Inc.), which uses the Mattabi mill to process its ore.

The Thierry Mine (Umex Inc.) at Pickle Lake, has been shut down for the past six years. Umex Inc. is re-evaluating the Thierry copper-nickel and other associated deposits in view of the increased interest in base metals in general and nickel in particular.

Camreco Inc. has carried out a major reassessment of the Goldlund and Windfall properties in Echo Township with a view to re-opening the Goldlund mill. A drill program conducted in 1987-88 discovered additional zones, several of which may have open-pit potential. A drill program is underway to add to these new reserves and support a feasibility study on re-opening the mill.

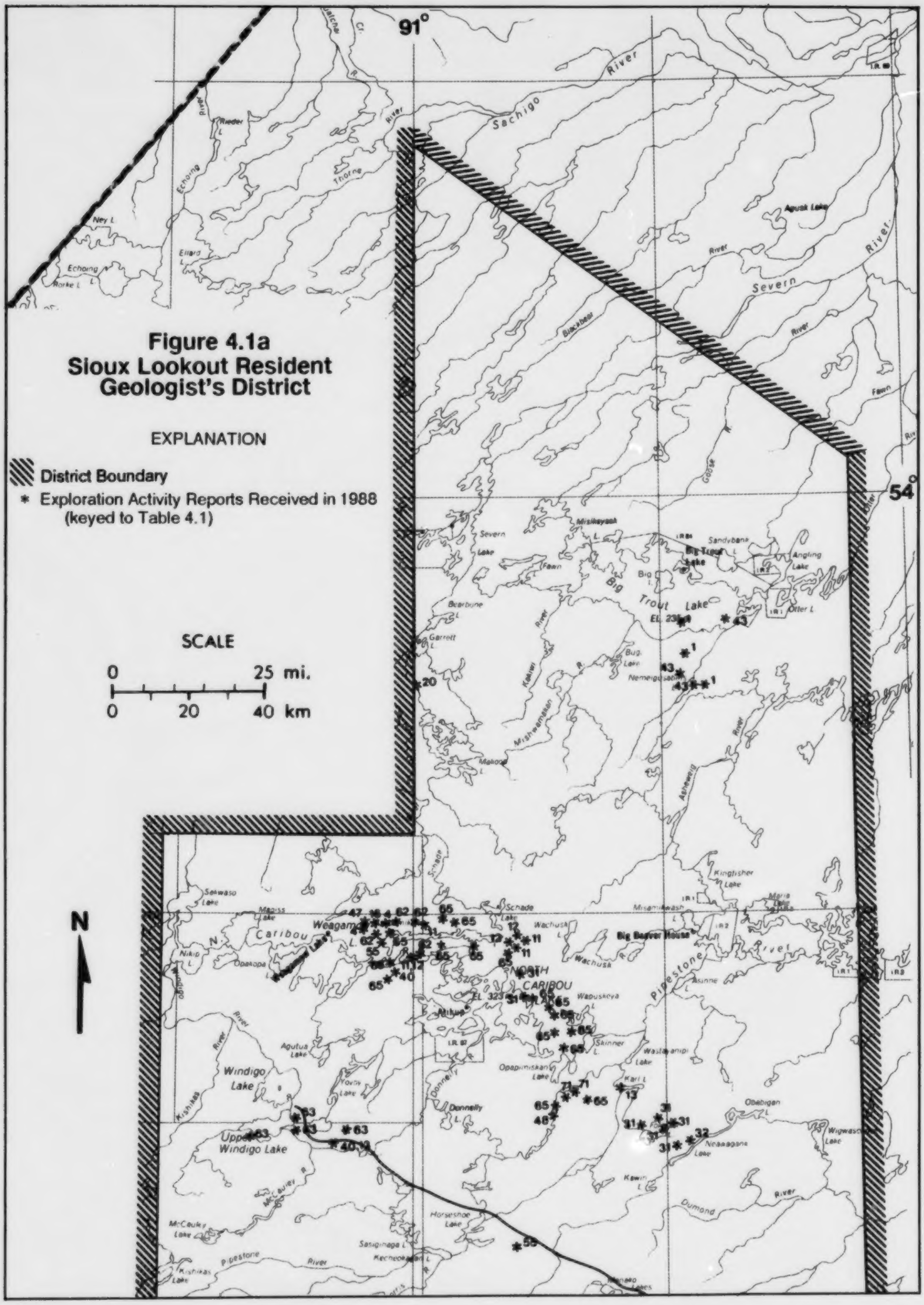


Figure 4.1a
Sioux Lookout Resident
Geologist's District

EXPLANATION

▨ District Boundary

* Exploration Activity Reports Received in 1988 (keyed to Table 4.1)

SCALE
0 25 mi.
0 20 40 km
N
91°
54°
Sachigo River
Severn River
Echoing River
Thorne River
Ney L.
Ellard L.
Echoing
Rorke L.
Apisuk Lake
Blackbear
Fawn
Goose R.
Misikeyask L.
Severn Lake
Fawn
Sandybank L.
Big Trout Lake
Big Trout Lake
Angling Lake
Otter L.
Bearbone L.
Garrett L.
Bug. Lake
Nemeigusabins
EL 23
Mishamattawa R.
Asheweig River
Mahood
Kingfisher Lake
Sakwaso Lake
Magiss Lake
Caribou L.
Weagamow L.
Nikip L.
Opakopa
Schade
Wachusk L.
Wachusk
Big Beaver House
Misamikwash
Pipestone River
Asinne
NORTH CARIBOU
Wapuskeya
EL 323
Skinner L.
Agutua Lake
Windigo Lake
Yoyny Lake
Donnelly L.
Donnelly
Opapimiskan Lake
Wastayanipi Lake
Kari L.
Obabigan
Wigwasan Lake
Neawagank Lake
Upper Windigo Lake
McCauley R.
McCauley Lake
Horseshoe Lake
Kawin L.
Dumond River
Sasiginaga L.
Kecheokagan L.
Pipestone River
Kishikas Lake
Kishikas
I.R.
1
43
20
47
62
65
55
40
11
12
31
13
71
48
33
63
32
53

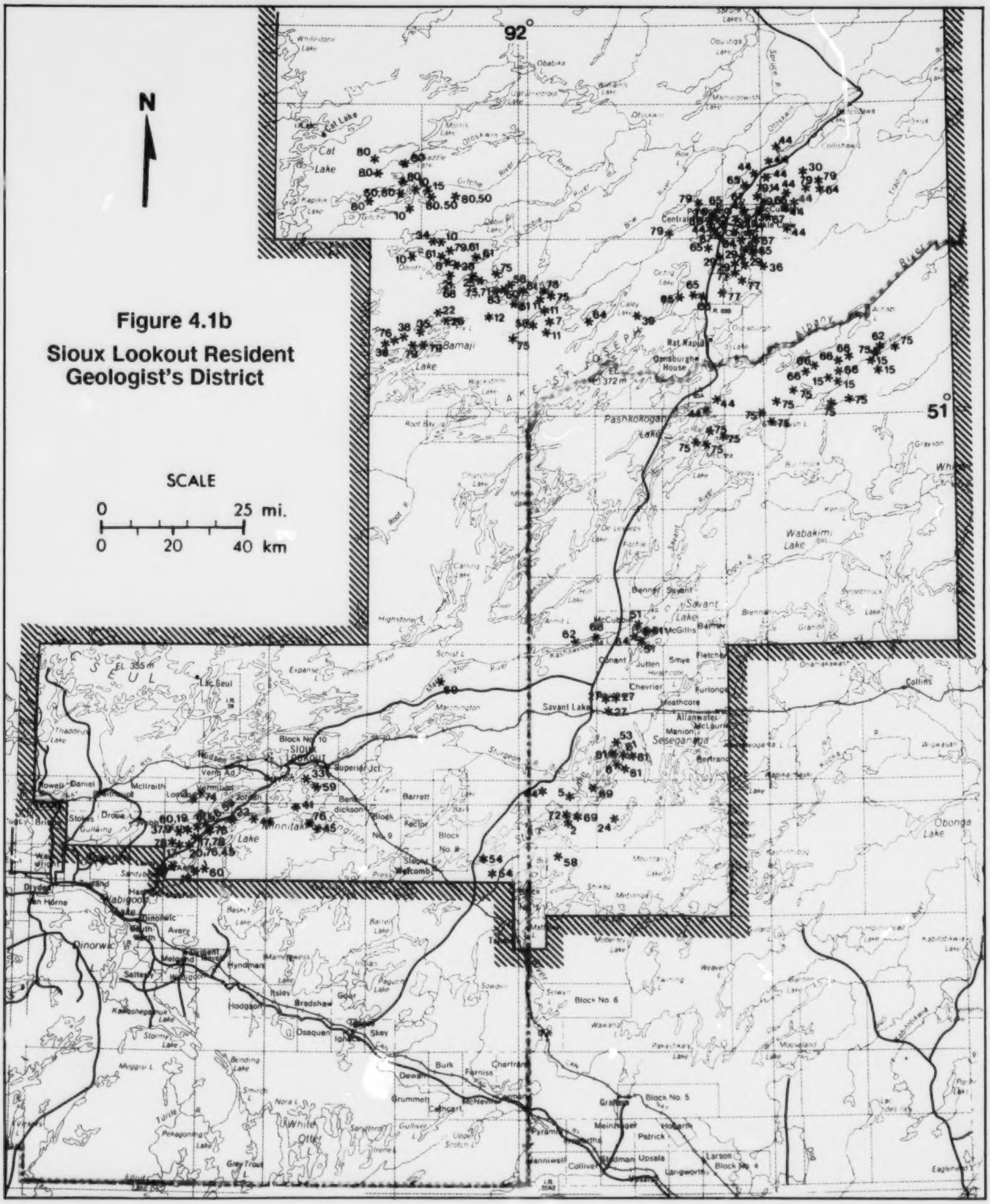
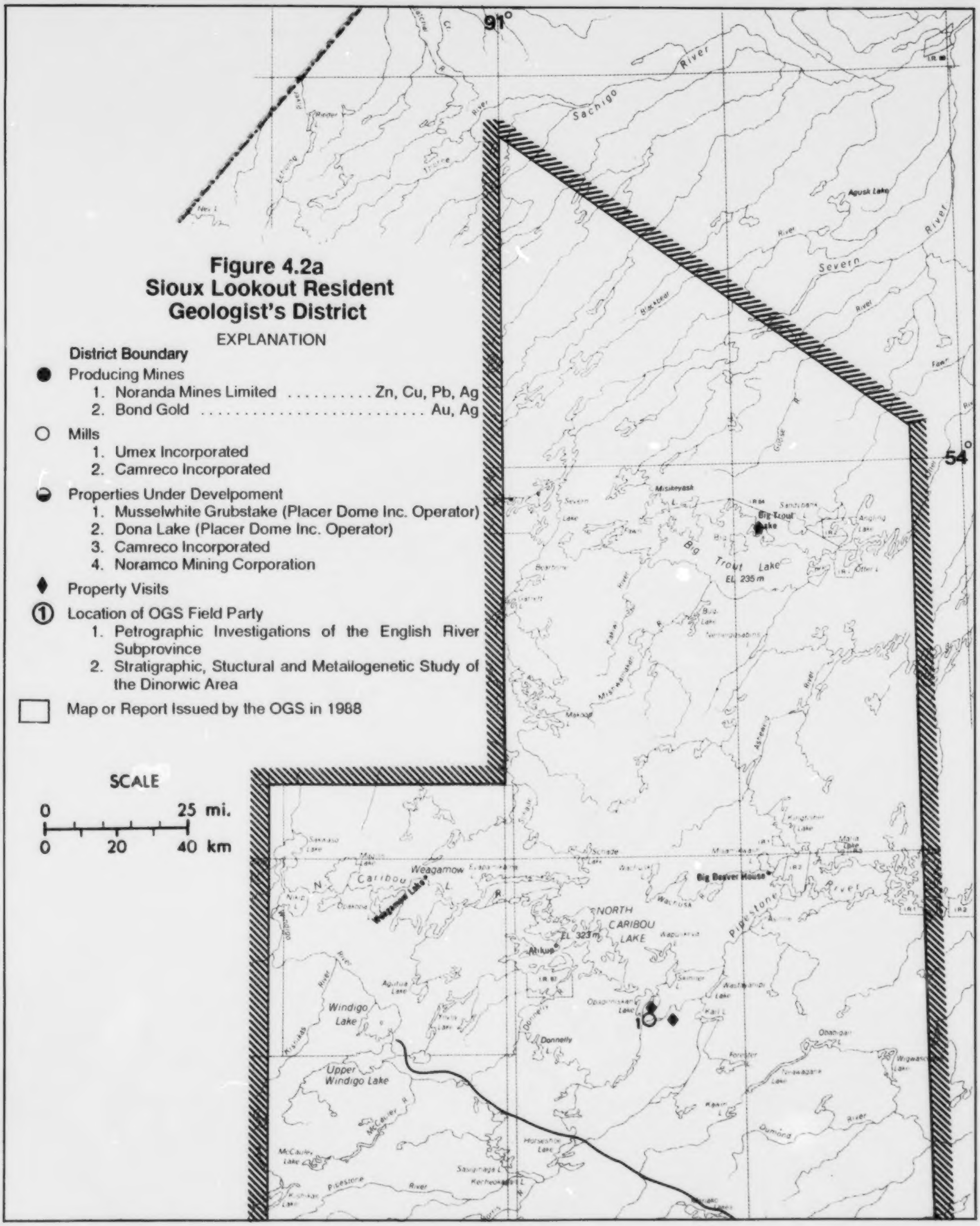


Figure 4.1b
Sioux Lookout Resident Geologist's District

N
SCALE
0 25 mi.
0 20 40 km
92°
51°
Cat Lake
Bamaji Lake
Pashkokogan Lake
Osnaburgh House
Savant Lake
Sesegannaga
Wabakimi Lake
Sioux Lookout
Lac Seul
Minnitaki Lake
Wabigoon Lake
Dryden
Dinorwic
Superior Jct.
Ignace
White Otter L.
Obonga Lake
Albany River
Lake St. Joseph
Block No. 10
Block No. 6
Block No. 5
Block No. 4



91°
54°
Sachigo River
Severn River
Agusk Lake
Big Trout Lake
EL 235 m
Musselwhite
Sandy Lake
Weagamow Lake
Weagamow L
N. Caribou
NORTH CARIBOU LAKE
EL 323 m
Big Beaver House
Pipestone River
Windigo Lake
Upper Windigo Lake
McCauley Lake
Horseshoe Lake
Donnelly L
Opapimiskan Lake
Wigwasan Lake
Dumond
Pipestone River
SCALE
0
25 mi.
0
20
40 km

Figure 4.2a Sioux Lookout Resident Geologist's District

EXPLANATION

District Boundary

● Producing Mines

1. Noranda Mines Limited .... Zn, Cu, Pb, Ag
2. Bond Gold .... Au, Ag

○ Mills

1. Umex Incorporated
2. Camreco Incorporated

◒ Properties Under Develpoment

1. Musselwhite Grubstake (Placer Dome Inc. Operator)
2. Dona Lake (Placer Dome Inc. Operator)
3. Camreco Incorporated
4. Noramco Mining Corporation

♦ Property Visits

① Location of OGS Field Party

1. Petrographic Investigations of the English River Subprovince
2. Stratigraphic, Stuctural and Metallogenetic Study of the Dinorwic Area

☐ Map or Report Issued by the OGS in 1988

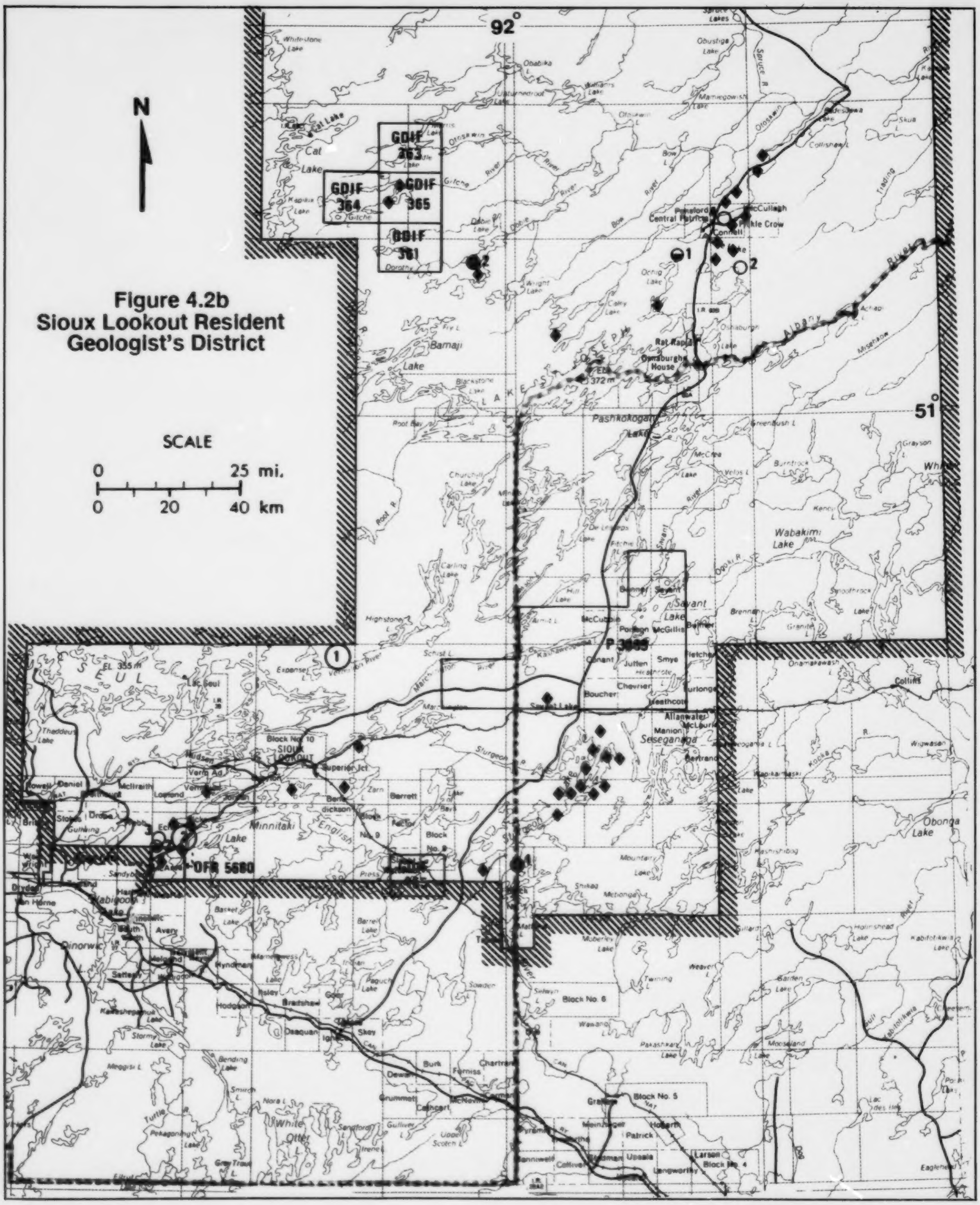

N
SCALE
0
25 mi.
0
20
40 km
92°
51°
GDIF 363
GDIF 364
GDIF 365
GDIF 361
P 3055
OFR 5580
Cat Lake
Bamaji Lake
Pashkokogan Lake
Wabakimi Lake
Savant Lake
Sesegamaga
Lac Seul
Sioux Lookout
Minnitaki Lake
Obonga Lake
Pickle Crow
Central Patricia
Connell
McCullagh
Osnaburgh House
Rat Rapids
Albany River
Superior Jct.
Block No. 10
Block No. 9
Block No. 8
Block No. 6
Block No. 5
Block No. 4
Allanwater
McGillis
Conant
Jutten
Smye
Boucher
Chevrier
Heathcote
Fletcher
Barrett
Dinorwic
Avery
Hyndman
Bradshaw
Hodgson
Osaquan
Ignace
Skey
White Otter Lake
Graham
Patrick
Hobarth
Upsala
Larson
Langworthy
Banniwell
Collings
Stormy Lake
Kabitotikwia Lake
Eaglehead
1
2
①

Figure 4.2b
Sioux Lookout Resident Geologist's District

TABLE 4.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	#697895	1987/88 - GEOLOGY, GEOCHEMICAL, AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN BEARDY CREEK AREA AND NEMEGUSABIN LAKE AREA.
2	ABERMIN CORPORATION	1987 - GEOLOGY, GEOCHEM. WK.,ASSAYS, DIAMOND DRILLING IN THE SIXMILE LAKE AREA.
3	ACADIA MINERAL VENTURES LIMITED	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN VERMILION TB
4	AGNICO-EAGLE MINES LIMITED	1987 - DIAMOND DRILLING, ASSAYS IN THE KEEYASK LAKE AREA.
5	ALMADEN RESOURCES CORPORATION	1987 - DIAMOND DRILLING, ASSAYS IN THE FOURBAY LAKE AREA.
6	ALOTTA RESOURCES LIMITED	1987 - DIAMOND DRILLING, ASSAYS IN THE SQUAW LAKE AREA.
7	AMOCO CANADA PETROLEUM COMPANY LIMITED	1987/88 - BENEFICIATION STUDY, GEOLOGY, DIAMOND DRILLING IN THE DUFFELL LAKE AREA; BENEFICIATION STUDY IN THE WRIGHT LAKE AREA.
8	ARGYLE VENTURES INCORPORATED	1988 - GROUND ELECTROMAGNETIC SURVEY IN THE MEEN LAKE AREA.
9	ASARCO EXPLORATION COMPANY OF CANADA L.	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE ECHO TOWNSHIP AREA.
10	BAYAURA MINES LIMITED (BAYKAL, ORHAN)	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE MCVICAR LAKE AND MEEN LAKE AREA.
11	BAZINET, ERNEST WALTER (AMOCO CANADA PETROLEUM COMPANY LIMITED)	1987 - GEOLOGY, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN WRIGHT LAKE AND DUFFELL LAKE AREAS; DIAMOND DRILLING, ASSAYS IN THE ERICHSEN LAKE, KEEYASK LAKE AND SEESEEP LAKE AREAS; BENEFICIATION STUDY IN THE WRIGHT LAKE AREA.
12	BEAUFIELD RESOURCES INCORPORATED (MILNER CONSOLIDATED SILVER MINES L.)	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN THE DRUM LAKE AND KAWASHE LAKE AREAS; DIAMOND DRILLING, ASSAY, GEOLOGY, PROPERTY REPORT IN THE ERICHSEN LAKE, KEEYASK LAKE AND SEESEEP LAKE AREAS.
13	BERTRAND, CLAUDE (GAIGNARD, MAURICE) (LARIVIERE, MARC) (FLAGSHIP RESOURCES LIMITED)	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN NANGO LAKE AREA. 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE KARL LAKE AREA.
14	BEST, ALLAN (HODGE, J.)	1987 - MECHANICAL WORK IN FOURBAY LAKE AREA; GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE TARP LAKE AREA.
15	BHP-UTAH MINES LIMITED	1985 and 1988 - GEOLOGY IN THE MCVICAR LAKE AREA 1988 - DIAMOND DRILLING IN THE MCVICAR LAKE AREA 1988 - GND MAG & EM IN AUGUST, ACHAPI AND LOWRY LAKE AREAS
16	BONIWELL, J. B. (MEDD, S.)	1987 - INDUCED POLARIZATION SURVEY IN KEEYASK LAKE AREA
17	BUMBU, COSTY (NORAD RESOURCES LIMITED)	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN ECHO TOWNSHIP AND MCAREE TOWNSHIP.
18	CAMINE RESOURCES INCORPORATED	1988 - MECHANICAL WORK, GEOLOGY, GEOCHEMICAL, ASSAYS AND GROUND MAGNETOMETER IN MCAREE TOWNSHIP.
19	CAMRECO INCORPORATED (NORONTEX)	1987/88 - PROPERTY REPORT, DIAMOND DRILLING, ASSAYS IN ECHO TOWNSHIP.
20	CANADIAN NICKEL COMPANY LIMITED	1971 - DIAMOND DRILLING IN MAKOOP RIVER AREA 1988 - GROUND MAGNETOMETER IN MCAREE TOWNSHIP.
21	CANHORN MINING CORPORATION	1988 - DIAMOND DRILLING, ASSAYS IN THE DONA LAKE AREA.
22	CASABAR RESOURCES INCORPORATED	1987/88 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, DIAMOND DRILLING, ASSAYS, TRENCHING, STRIPPING IN NABEMAKOSEKA LAKE.
23	CONCENTRATED RARE EARTH MINERALS L.	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE KABIK LAKE AND PICKEREL TOWNSHIP AREA.
24	COPCONDA-YORK RESOURCES INCORPORATED	1983/84 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, PROPERTY REPORT IN QUEST LAKE AREA.
25	CRAIG, JOHN H. (MURODCH AND FINDLAY) (NAPOLEON EXPLORATION CORPORATION)	1988 - DIAMOND DRILLING IN THE KAWASHE LAKE AREA.
26	CREAM SILVER MINES LIMITED	1987 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN FRY LAKE AREA.
27	CUMBERLAND RESOURCES LIMITED	1985 - PROPERTY REPORT, ASSAYS IN BECKINGTON LAKE AREA. 1986/87 - DIAMOND DRILLING, GROUND ELECTROMAGNETIC AND BOREHOLE PEM, PROPERTY REPORT, ASSAYS, GEOCHEMICAL SURVEY IN EVANS LAKE AREA.
28	DARVEAU, RENE ROBERT, JEAN	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN NABEMAKOSEKA LAKE AND MEEN LAKE AREA.
29	DOME EXPLORATION (CANADA) LIMITED	1986/87 - DIAMOND DRILLING IN THE DONA LAKE AREA.
30	DIA MET MINERALS LIMITED	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN COLLISHAW LAKE AND FIRSTLOON LAKE AREAS.
31	ESSO RESOURCES CANADA LIMITED	1987/88 - MANUAL WORK, GEOLOGY, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, ASSAYS, DIAMOND DRILLING IN FORESTER LAKE AREA. 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC, GEOLOGY IN NEAWAGANK LAKE AREA; 1987 - DIAMOND DRILLING, ASSAYS IN NEAWAGANK LAKE AREA 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN NORTH CARIBOU LAKE AREA.

TABLE 4.1 Continued

Number on Figure	Individual or Company	Activity
32	EXPLORA-FIVE LIMITED (ROBERT, JEAN) (BERTRAND, CLAUDE) (POWER EXPLORATION INC.)	1987 - DIAMOND DRILLING AND ASSAYS IN NEAWAGANK LAKE AREA
33	FAIRSERVICE, ROBERT JOHN	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN DRAYTON TP.
34	FRANKFIELD EXPLORATIONS LIMITED	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN THE MEEN LAKE AREA
35	FRY LAKE SYNDICATE (FIRTH, NORMAN)	1987 - GROUND ELECTROMAGNETIC SURVEY, GEOLOGY IN FRY LAKE AREA
36	GOLDEN SHADOW RESOURCES	1986 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, ASSAYS IN DONA LAKE AREA
37	GOLDLUND MINES LIMITES	1987 - MANUAL WORK, MECHANICAL WORK AND POWER STRIPPING ON ECHO TOWNSHIP MAP SHEET
38	GOLDFIELDS CANADIAN MINING LIMITED	1988 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE FRY LAKE AND WESLEYAN LAKE AREAS
39	GOLDEN TERRACE RESOURCES CORPORATION	1988 - DIAMOND DRILLING IN MATAPESATAKUN BAY AREA
40	GAIGNARD, MAURICE (LARIVIERE, MARC) (FLAGSHIP RESOURCES LIMITED)	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, GEOCHEMICAL, PROPERTY REPORT IN THE NANGO LAKE AREA 1987 - GEOLOGY, GEOCHEMICAL, ASSAYS IN RANDALL LAKE AREA
41	GOLDEN RANGE RESOURCES INC.	1984 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN PARNES LAKE AREA
42	HIGHLAND CROW RESOURCES LIMITED	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, IP SURVEY, SAMPLING, ASSAYS, DIAMOND DRILLING IN DONA LAKE AND TARP LAKE AREAS
43	INTERNATIONAL PLATINUM CORPORATION	1987 - DIAMOND DRILLING IN NEMEGUSABINS LAKE AREA 1988 - DIAMOND DRILLING ON EAST OF BEARDY CREEK MAP SHEET AND NEBEGUSABINS LAKE AREA
44	KERR ADDISON MINES LIMITED	1987 - DIAMOND DRILLING, ASSAYS IN WEIBURG LAKE AREA 1987 - DIAMOND DRILLING, ASSAYS, GROUND ELECTROMAGNETIC SURVEY IN DONA LAKE AREA 1987/88 - DIAMOND DRILLING, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, OVERBURDEN DRILLING, GEOCHEMICAL, GEOLOGY, ASSAYS IN FIRSTLOON LAKE AND TARP LAKE AREAS 1988 - GEOLOGY, ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN ATIK LAKE, CARON LAKE AND COLLISHAW LAKE AREAS 1988 - GROUND MAGNETOMETER AND ELECTROMAGNITIC SURVEY, SAMPLING, ASSAYS IN THE RIACH LAKE AREA
45	LOYDEX RESOURCES	1983 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE PARNES LAKE AREA 1984/1985 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY ON THE ECHO TOWNSHIP MAP SHEET
46	LAC MINERALS LIMITED	1987 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN KABIK LAKE AND PICKEREL TOWNSHIP MAP SHEET
47	LITTLE ABITIBI RIVER RESOURCES INC.	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE KEEYASK LAKE AREA
48	M. J. LABELLE COMPANY LIMITED	1987/1988 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE ZEEMEL LAKE AREA
49	MARIETTA RESOURCES CORPORATION	1986 - IP SURVEY IN TARP LAKE AREA
83	MASSIVE RESOURCES LIMITED	1987 - GND MAGNETOMETER AND ELECTROMAG., GEOLOGY IN KAWASHE LAKE AREA
50	MASTER RESOURCES AND DEVELOPMENT L.	1987 - GND MAGNETOMETER AND ELECTROMAG., GEOLOGY IN KAWASHE LAKE AREA
51	MCARTHUR MILLS EXPLORATION LIMITED	1987 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, SAMPLING, ASSAYS IN UNDESIGNATED AREA #19 (See * Below) 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN GREBE LAKE AND MCCUBBIN TOWNSHIP AREA
52	MICHELE GOLD MINES LIMITED (SANDS MINERAL CORPORATION)	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, ASSAYS, BASIL TILL SURVEY IN KAWASHE LAKE AREA
53	MINE LAKE MINERALS INCORPORATED (MINE LAKE RESOURCES INCORPORATED)	1986/1987 - GEOLOGY, DIAMOND DRILLING, GROUND ELECTROMAGNETIC SURVEY, GEOCHEMICAL, PROPERTY REPORT IN BECKINGTON LAKE AREA
54	MINNOVA INCORPORATED	1987 - GROUND MAGNETOMETER IN PENASSI LAKE AREA; GROUND MAGNETOMETER AND ELECTROMAGNETIC IN VALORA LAKE AREA
55	MOSS RESOURCES LIMITED	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN KEEYASK LAKE AND WAPAMISK CREEK AREAS
56	NAHANNI MINES LIMITED	1985 - ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY WAS DONE IN KABIK LAKE AND PICKEREL TOWNSHIP AREA
57	NEWFIELDS MINERALS INCORPORATED (NORTHERN DYNASTY) (WESTFIELD MINERALS INCORPORATED)	1987/1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN THE KEEYASK LAKE AND SEESEEP LAKE AREAS

*Undesignated Area #19 includes Poisson, McGillis, Jutten, Smye, Bulmer and Fletcher Townships

TABLE 4.1 Continued

Number on Figure	Individual or Company	Activity
58	NORANDA EXPLORATION COMPANY LIMITED	1985 - AN AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN MCAREE TP. 1986 - DIAMOND DRILLING AND ASSAYS IN BELL AND SIXMILE LAKE AREAS 1987 - BENEFICIATION STUDY, ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC, GEOCH. IN KAWASHE; BENE.STUDY, A, MANUAL WORK IN DUFFEL LAKE AREA
59	NORLODE RESOURCES INCORPORATED	1988 - DIAMOND DRILLING IN DRAYTON TOWNSHIP
60	NORONTEX	1984 - PROPERTY REPORT IN MCAREE TOWNSHIP 1987/ 1988 - PROPERTY REPORT, DIAMOND DRILLING, ASSAYS IN ECHO TOWNSHIP (NON-ASSESSMENT)
61	NORTH AMERICAN RARE METALS (POWER EXPLORATIONS INCORPORATED)	1987/ 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN DOBIE LAKE AND KAWASHE LAKE AREAS; GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN MEEN LAKE AND NABEMAKOSEKA LAKE AREAS
62	NORTHERN DYNASTY EXPLORATIONS LIMITED	1987 - DIAMOND DRILLING, ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN KEEYASK LAKE AREA; GEOCHEMICAL, GEOLOGY, ASSAY, GROUND MAGNETOMER AND ELECTROMAGNETIC SURVEY IN SEESEEP LAKE AREA 1988 - DIAMOND DRILLING, OVERBURDEN DRILLING IN ACHAPI LAKE AREA; GEOCHEMICAL, ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN ARMIT LAKE AREA
63	OREX RESOURCES LIMITED	1987 - GEOLOGY, GEOCHEMICAL, ASSAYS IN NANGO LAKE AND UPPER WINDIGO LAKE AREAS 1987 - GEOLOGY, GEOCHEMICAL, ASSAYS, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE YOYOY LAKE AREA
64	PLACER DOME	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE FIRST LOON LAKE AREA 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN THE GREBE LAKE AND MCCUBBIN TOWNSHIP, MATAPESATAKUN BAY, CALEY LAKE AND DONA LAKE AREAS
65	POWER EXPLORATIONS INCORPORATED (NORTH AMERICAN RARE METALS LIMITED) (EXPLORA-FIVE LIMITED)	1987 - GEOLOGY, DIAMOND DRILLING, ASSAYS IN ZEEMEL LAKE AREA; DIAMOND DRILLING, ASSAYS, GEOLOGY, TRENCHING IN DONA LAKE AND AKOW LAKE AREAS; GEOLOGY IN ERICHSEN LAKE AREA; GEOLOGY, ASSAYS, GEOCHEMICAL, STRIPPING IN KEEYASK LAKE AREA; GROUND MAGNETOMETER AND ELECTROMAGNETIC, ASSAYS, GEOCHEMICAL, GEOLOGY IN LITTLE OCHIG LAKE AREA; DIAMOND DRILLING IN NEAWAGANK LAKE AREA; GEOLOGY, GEOCHEMICAL, ASSAY, TRENCHING IN NORTH CARIBOU LAKE AREA; GEOLOGY, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN TARP LAKE AREA 1987/ 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN DOBIE LAKE KAWASHE LAKE, MEEN LAKE AND NABEMAKOSEKA LAKE AREAS; GEOLOGY, GEOCHEMICAL, ASSAYS, DIAMOND DRILLING, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN SEESEEP LAKE AND SKINNER LAKE AREAS; 1988 - DIAMOND DRILLING, ASSAYS IN RANDALL LAKE AREA
66	PURE GOLD RESOURCES INCORPORATED	1986 - GEOLOGY IN TARP LAKE AREA 1987 - DIAMOND DRILLING, ASSAYS IN THE ACHAPI LAKE, AUGUST LAKE AND LOWRY LAKE AREAS
67	QUINTERRA RESOURCES INCORPORATED	1986 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN DONA LAKE, TARP LAKE AND FIRSTLOON LAKE AREAS
68	REDAURUM RED LAKE MINES LIMITED (RAMSAY, R.)	1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC, GEOLOGY, GEOCHEMICAL, ASSAYS IN ARMIT LAKE AND GREBE LAKE AND MCCUBBIN TOWNSHIP AREAS
69	REDDEN, J. W. (LUNDMARK, H.) (PRIMROSE GOLD RESOURCES) (ROBERECKI, E.)	1987 - PROPERTY REPORT IN KIMMIWIN LAKE AREA; MECHANICAL WORK, DIAMOND DRILLING, STRIPPING, TRENCHING, ASSAYS IN SIXMILE LAKE AREA 1988 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, CONSULTANTS STUDY IN SQUAW LAKE AREA
70	ROCKSPAN RESOURCES LIMITED	1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY IN TARP LAKE AREA
71	SANTA MARIA RESOURCES LIMITED	1986/ 1987 - DIAMOND DRILLING IN KAWASHE LAKE AREA 1987/ 1988 - DIAMOND DRILLING, ASSAYS IN THE ZEEMEL LAKE AREA
72	SANTANA PETROLEUM LIMITED	1985 - INDUCED POLARIZATION SURVEY IN SIXMILE LAKE AREA
73	SILVERSIDE RESOURCES INCORPORATED	1987 - DIAMOND DRILLING, ASSAYS IN TARP LAKE AREA
74	SMITH, DONALD E.	1987/ 1988 - MAGNETOMETER AND ELECTROMAGNETIC SURVEY, DIAMOND DRILLING IN VERMILION TOWNSHIP
75	ST. JOE (CANADA) INCORPORATED	1986 - GROUND MAGNETOMETER AND ELECTROMAGNETIC, INDUCED POLARIZATION SURVEY IN KAWASHE LAKE AREA 1986/ 1987 - DIAMOND DRILLING, ASSAYS IN DRUM, WRIGHT AND KAWASHE LAKE AREAS 1987 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN PASHKOKOGAN, LAKE, LOWRY LAKE, GREENBUSH LAKE, WEBSTER LAKE, HEATHER LAKE ACHAPI LAKE, AUGUST LAKE AND CARON LAKE AREAS
76	SULPETRO MINERALS LIMITED	1984 - DIAMOND DRILLING, GEOLOGY, ASSAYS, GROUND ELECTROMAGNETIC SURVEY IN MCAREE TOWNSHIP; GROUND ELECTROMAGNETIC SURVEY IN PARNES LAKE AREA; MANUAL WORK IN WESLEYAN LAKE AREA

TABLE 4.1 Continued

Number on Figure	Individual or Company	Activity
77	SUNBURST EXPLORATIONS LIMITED	1986/ 1987 - GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN DONA LAKE AND COUCHEEMOSKOG LAKE AREAS 1988 - DIAMOND DRILLING IN COUCHEEMOSKOG LAKE AREA
78	TARBUSH LODE MINING COMPANY	1983 - GROUND ELECTROMAGNETIC SURVEY, GEOCHEMICAL IN ECHO TOWNSHIP 1985 - AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY, DIAMOND DRILLING, ASSAYS, PROPERTY REPORT, GEOCHEMICAL IN ECHO TOWNSHIP AND KABIK LAKE AND PICKEREL TOWNSHIP AREAS; AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN MCAREE TOWNSHIP AREA
79	UMEX INCORPORATED	1987 - DIAMOND DRILLING, ASSAYS IN DONA LAKE, MEEN LAKE AND TARP LAKE AREAS 1988 - DIAMOND DRILLING, ASSAYS, GEOLOGY, GEOCHEMICAL IN FIRSTLOON LAKE AND FRY LAKE AREAS; AIR MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN PONSFORD TOWNSHIP; GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY IN KAPKICHI LAKE AREA
80	UTAH MINES LIMITED	1986 - DIAMOND DRILLING, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, ASSAYS IN BAGGY LAKE AND SADDLE LAKE AREAS 1987 - DIAMOND DRILLING, GROUND MAGNETOMETER AND ELECTROMAGNETIC SURVEY, GEOLOGY, ASSAYS IN MCVICAR LAKE AND STOUGHTON LAKE AREAS
81	VILLENEUVE RESOURCES	1987 - DIAMOND DRILLING IN SQUAW LAKE AREA 1988 - DIAMOND DRILLING IN BECKINGTON LAKE AREA
82	WILKINSON, DON	1984 - STRIPPING, TRENCHING, BOREHOLE DRILLING IN ECHO TOWNSHIP AREA

TABLE 4.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1974	1,011	3,223	5,659	38,049.0	6,255	102	44,604
1975	1,019	2,489	3,903	38,492.7	18,953	1,858	59,503.7
1976	1,185	1,120	3,958	27,111.0	11,555	185	38,851
1977	1,261	1,320	3,760	17,880.1	13,931	946	32,757.1
1978	2,018	765	5,084	33,371.3	57,501	600	91,472.3
1979	1,012	1,061	5,045	30,869	27,605.4	1,949	60,423.4
1980	3,485	1,391	7,068	42,633	13,524	10,800	66,957
1981	2,861	1,582	8,303	42,588	232,184	4,866	287,626
1982	842	1,766	7,737	35,486	73,486	13,900	167,289
1983	4,398	1,164	10,971	69,563.8	85,536.5	23,730	197,223.1
1984	5,009	4,074	10,625	42,425	113,830	24,941.1	205,214.64
1985	2,513	3,972	9,166	92,051	148,105	20,376	294,891
1986	7,815	3,046	13,935	109,952.4	263,118.4	29,245.4	429,481.5
1987*	5,540	1,918	18,786	255,334.04	345,747.6	49,750	691,581.8
1988**	2,308	2,281	18,813	170,442.98	278,256.38	53,847.3	544,224.52

Bond Gold Canada Inc. has successfully started up their Golden Patricia Mine, 80 km southwest of Pickle Lake. The mill was turned over in late August 1988, and was placed in full production on October 1, 1988.

Construction of Placer Dome Inc.'s Dona Lake Mine, 11 km southeast of Pickle Lake, is nearing completion. Start–up of the the mill is planned for January 1989. Full production is expected in the second quarter of 1989.

The Musselwhite Grubstake (operator Placer Dome Inc.) is evaluating the East Bay zones of the Opapimiskan Lake gold property. A vertical shaft was completed in October 1988 and evaluation of the orebody will start in December 1988. Based on the results of this evaluation, a feasibility study on a 1500 ton per day gold mill will be done. The East Bay zones are in addition to the original North Anticline Deposit, which has a gold mineral inventory developed by decline.

RESIDENT GEOLOGIST'S ACTIVITIES

The Resident Geologist's program was considerably augmented by the addition of G.W. Seim as Staff Geologist in January 1988. Seim opened a temporary office in Pickle Lake for the summer months and conducted a program of field visits and property examinations in the North Caribou and Central Uchi volcanic belts.

The Resident Geologist continued a program of property visits in the Sturgeon Lake, Sandybeach Lake, and Echo Township areas. All operating and shut–down mines in the District were visited at least once during the year.

The third year of the Geological Data Inventory Folio Program was conducted by C. Proctor. Approximately 60 percent of the exploration files have been covered by recently prepared data folios. This program was funded under the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

Three of the four Ontario Geological Survey mapping parties working within the Mining Division were visited. Several field trips in the area were conducted with Ontario Geological Survey personnel and exploration company personnel.

Several lectures were given to local secondary schools and two Junior Ranger Camps by the Resident Geologist and staff. The Resident Geologist participated in a mining and exploration seminar given by Ministry staff to the Big Trout Band on Big Trout Lake Indian Reserve.

DEVELOPMENT PROJECTS

Placer Dome Inc., when contacted in late November 1988, had nearly completed construction of their Dona Lake Mine which is located 11 km southeast of Pickle Lake. Approximately 20 employees were on site with the contract development and construction workers. The Mine management expects to start up the 500 ton per day mill in January and to be in full production by the second quarter of 1989. Gold will be recovered by milling, cyanidation, and carbon–in–pulp absorption. Approximately 130 workers will be employed. The project is budgeted at $42.6 million and is expected to produce gold from ore with a grade of 0.24 ounce gold per ton (The Northern Miner, April 18, 1988, p.1).

The Musselwhite Grubstake (Placer Dome Inc., operator), is conducting an advanced exploration program on the East Bay zones on Opapimiskan Lake. Opapimiskan Lake is located in the North Caribou Lake volcanic belt, 115 km north of Pickle Lake. The East Bay zones are located 4 km to the southwest of the North Anticline gold deposit, previously explored by the Grubstake. Drilling programs on the East Bay zones have outlined six million tons at a grade of 0.20 ounce gold per ton (The Northern Miner, October 10, 1988, p.28). The present program consists of shaft sinking, drifting, underground drilling, and bulk sampling to support a feasibility study. Shaft sinking was completed to a depth of 239 m by September 1988. Drifts had reached ore by the end of November 1988, and the sampling program should be completed by March 1989. Pre–feasibility studies have suggested a 1500 t per day operation using a semi–autogenous mill, a ball mill, gravity concentration, cyanide leaching with carbon–in–pulp and high pressure stripping. The project would cost approximately $100 million dollars and employ 250 people when completed. Gold production would average 110 000 ounces of gold per year (R. Steward, Placer Dome Inc., personal communication, November 1988).

Camreco Inc. continued with a combined exploratory and re–evaluation program on the Goldlund, Camreco (formerly Windfall), and Mistango properties in Echo and Laval townships, 35 km southwest of Sioux Lookout. The Goldlund Mine produced 15 000 ounces of gold between June 1983 and March 1985, when it was shut down and allowed to flood. The mine is serviced by a decline to the first level and a renovated three–compartment shaft to 251 m. Four levels were developed, but all production came from the first level and an open pit. Reserves are 211 000 tons, at 0.10 ounce gold per ton, of potential open pit mineable ore, and an additional 570 000 tons, at 0.15 ounce gold per ton, from subsurface blocks.

The adjoining Camreco Property has probable reserves of 800 000 tons at 0.15 ounce gold per ton. The Camreco and Goldlund mines are connected on the first level of the Goldlund Mine.

Work carried out in 1987–88 confirmed several new zones, and the existence of a considerable tonnage of potential open pit mineable ore. A consultant's study suggested an additional drilling program be done to convert probable reserves into drill–indicated reserves. This program started in early December 1988.

One interesting result of recent exploration was the discovery and outlining of a potential tonnage of gold mineralization in silicified, carbonatized granodiorite. These zones have considerable width and are potentially more easily mined than the shallowly dipping quartz veins which were previously extracted.

The Goldlund mill is moth–balled and could readily be put into service. The mill is presently rated at 250 tons per day, but has the potential for expansion to 500 tons per day with equipment on site. The mill produced concentrate from a conventional ball mill, gravity separator, and flotation circuits.

Depending on the results of current drilling, a decision to proceed to a full–scale feasibility study on re–opening the mine will be made (J. Langelaar, Norontex Exploration Limited, personal communication, December 3, 1988).

Noramco Mining Corporation has undergone a change of control with Breakwater Resources Ltd. assuming management of the company. The new management have re–evaluated the corporation's various exploration and development properties. Recent work at the Pickle Crow Mine has led to a decision that insufficient mineable reserves have been established to justify a feasibility study on re–opening the Pickle Crow Mine (George Cross News Letter Limited, No. 228, November 27, 1988). Noramco Explorations Inc. will spend $750 000 on an exploration drilling program to establish potential mineable reserves. Surface exploration is continuing on both the Pickle Crow and Central Patricia properties.

MINING ACTIVITY

The Mattabi Mine of Mattabi Mines Limited and the Lyon Lake Mine of Noranda Minerals Inc. are located in the south Sturgeon Lake base–metal area. Mattabi Mines Limited is owned by Noranda Inc. (60%) and Abitibi Price Incorporated (40%). Ore from both operations, drawn from several sources, was treated at the Mattabi mill to produce zinc, copper, and lead concentrates. For most of 1988, the two companies extracted and milled ore at the rate of one million tons per year. The Mattabi Mine, having exhausted its ore reserves, shut down in September 1988. Heavy rains, which flooded underground workings, advanced shut down by several weeks. The Lyon Lake Mine will continue to mill ore at the Mattabi Mill. Ore will be stock piled and run through the mill on a bi–weekly schedule. The Lyon Lake Mine is projected to produce 350 000 tons of ore in the next twelve months. Noranda Exploration Company, Limited is continuing exploration at both the Mattabi and Lyon Lake mines. A Canada–Ontario Mineral Development Agreement study, managed by J. Franklin of the Geological Survey of Canada, has been underway for the past three years to aid exploration in the south Sturgeon Lake area.

Bond Gold Canada Inc. (formerly St. Joe Canada Inc.) capped an unusually rapid exploration–development–construction cycle at their Golden Patricia Mine by pouring their first gold bar in mid–August 1988. The mine–mill complex was in full production on October 1, 1988, and is expected to produce 48 000 ounces of gold per year from ore with a grade of 0.6 ounce gold per ton (The Northern Miner, November 7, 1988, p.16). The mill, now operating at 250 tons per day, is designed for expansion to 500 tons per day when development underground is capable of supporting this milling rate. Mine development costs are estimated at $25 million. The mine has a private air strip, and supply and employee transportation is by air.

The mill utilizes a conventional grinding, gravity separation, and cyanidation with zinc precipitation to recover gold. The latest proven reserves are given as 367 650 t grading 0.596 ounce gold per t (The Northern Miner, September 26, 1988, p.24)

The ore zone is a quartz vein with a mining width of 1.2 m and has been developed by two declines, 1 km apart. Gold mineralization in the vein has been traced for 6 km. Other gold–bearing zones have been discovered on the property and are undergoing exploration.

TABLE 4.3. ACTIVE OMEP PROGRAMS IN THE PATRICIA MINING DIVISION.

LOCATION	TOTAL EXPENDITURES	OMEP ASSISTANCE
ACHAPI LAKE	$ 43,223.00	$ 10,806
ARMIT LAKE	382,500.00	59,766
DUFFELL LAKE	259,280.00	64,819
ECHO TOWNSHIP	64,000.00	16,000
FIRST LOON LAKE	72,000.00	18,000
FORESTER LAKE	370,000.00	92,500
FRY LAKE	614,200.00	153,550
JUTTEN TOWNSHIP	120,000.00	30,000
KAWASHE LAKE	216,300.00	54,075
MCVICAR LAKE	611,250.00	152,812
MEEN LAKE	105,000.00	26,250
MUSKEG LAKE	1,665,000.00	396,500
N. CARIBOU LAKE	187,000.00	46,750
PICKEREL TOWNSHIP	11,600.00	2,900
SEESEEP LAKE	461,930.00	115,482
SHARRON LAKE	173,500.00	43,375
STURGEON LAKE	221,500.00	55,375
WIMBABIKA LAKE	84,000.00	21,000
WRIGHT LAKE	261,040.00	65,260
ZEEMEL LAKE	14,500,000.00	292,936
*TOTAL MINING DIVISION	$20,423,323.00	$1,718,156

MINERAL EXPLORATION ACTIVITY

Most exploration during 1988, in the Sioux Lookout District, was located north of 51° Latitude.

A significant increase in exploration activity did occur within the Wabigoon volcanic belt in Echo Township, and around Sturgeon and Savant lakes.

Almaden Resources Corporation completed an evaluation of their King Bay gold properties on Sturgeon Lake.

007 Precious Metals Incorporated have acquired several gold properties in the King Bay and Rainbow Island areas of Sturgeon Lake. The company intends to conduct a surface exploration and diamond drilling program during the winter of 1988–89.

Villeneuve Resources Ltd. drilled the Davidson–Carr and Powell gold properties in the North Arm of Sturgeon Lake.

Krigold Resources Limited acquired property on McEdwards Lake, formerly held by Moran Resources Limited. Previous surface sampling and drilling gave gold values in quartz–carbonate veins.

Orofino Resources Limited conducted a geological reconnaissance program on Sturgeon Lake and acquired a 17–claim block, south of the St. Anthony Gold Mine.

Minnova Inc. continued exploration on their property in the south Sturgeon Lake base–metal area.

Noranda Exploration Company, Limited continued with drill exploration on their base–metal properties on south Sturgeon Lake. They have optioned the Evans Lake area property of Cumberland Resources Ltd. and are conducting geological and geophysical surveys.

The Savant Lake area has seen increased activity during the year. Northern Dynasty Explorations Ltd. and Placer Dome Inc. have examined the gold potential of quartz–magnetite iron formation on the western side of Savant Lake. Umex Inc. is evaluating polymetallic gold–silver veins at the northern end of Savant Lake.

Inco Limited did geophysical surveys and conducted a drilling program for gold on a property at Sandybeach Lake, 40 km southwest of Sioux Lookout. Villeneuve Resources Ltd. drilled the Rosnel gold property, 15 km northeast of Sioux Lookout, in the spring of 1988.

Cream Silver Mines Ltd. conducted an extensive geological, geophysical, and stripping program near Split Lake, 15 km east of Sioux Lookout. Their large claim–group includes the Alcona and Split Lake gold mine sites.

Acadia Mineral Ventures Limited drilled the Eimiller gold property on Vermilion Lake, 24 km west–southwest of Sioux Lookout.

Northern Dynasty Explorations Ltd. explored their Misehkow River Property, which is located 64 km southeast of Pickle Lake. They intersected a wide unit of quartz–sericite schist which gave anomalous gold values (The Northern Miner, October 17, 1988, p.7).

Power Explorations Inc. continued exploration on their Kasagiminnis Lake Property. They have released preliminary mineral reserves. A visit to this property is described later in this report.

Power Explorations Inc. conducted geological studies on the Ohman Property, which is located to the north of the Kasagiminnis Pluton. This property has been optioned to Champion Gold Resources. Two separate gold zones have been found on the property and will be followed up (The Northern Miner, October 3, 1988, p.A4).

On their Dobie River Property, west of the Golden Patricia Mine, Power Explorations Inc. drilled six diamond–drill holes to follow up an intersection of 0.22 ounce gold per ton over 5 feet (1.5 m) (Dryden Observer, July 19, 1988, p.12).

BHP–Utah Mines Ltd. drilled several holes on their property in the McVicar Lake area.

Bayaura Mines Ltd. performed linecutting and geophysics on properties in the McVicar Lake area and in the Meen Lake area.

Noramco Exploration Incorporated continued major surface diamond drilling programs on their Pickle Crow and Central Patricia properties, to the end of February. The work on the Pickle Crow Property included testing of old mineralized zones and further testing of recently discovered mineralization. The work on the Central Patricia Property tested geophysical and geological targets as well as zones of known gold mineralization. A new zone was discovered in an iron formation to the northwest of the Springer Shaft. The iron formation is the same horizon that hosts the auriferous sulphide zones at Pickle Crow. Work resumed on both properties in late summer and is continuing. Concentration is on the delineation of zones of potentially economic mineralization through the use of extensive surface stripping and additional diamond drilling (Ken MacQueen, Noramco Exploration Incorporated, personal communication, November 1988).

Noront Resources Ltd. optioned and performed preliminary investigations on claims covering the Little July Falls gold occurrence, 25 km northeast of Pickle Lake.

Both Santa Maria Resources Ltd. and Esso Minerals Canada conducted diamond drilling programs on properties at the Neawagank Lake end of the North Caribou Lake greenstone belt. Power Explorations Inc., joint venture partner with Santa Maria Resources Ltd., intersected visible gold in narrow quartz–carbonate veins in mafic metavolcanics near iron formation, earlier in the year (H. Hodge and J. Adams, Geocannex Limited, personal communication, 1988; J. Pirie, Esso Minerals Canada, personal communication, 1988).

Power Explorations Inc. has also outlined zones of potentially economic gold mineralization on its Opapimiskan Lake North and Karl–Zeemel properties near the Musselwhite Grubstake's East Bay Project (*see* Property Examinations for Karl–Zeemel Prospect) The Opapimiskan Lake North Property was optioned to Ravenroc Resources Ltd. (The Northern Miner, May 16, 1988, p.15).

International Platinum Corp. has worked throughout the year on its property south of Big Trout Lake. Long zones of platinum–palladium and chromite mineralization have been traced by diamond drilling.

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM

In 1988, 12 Geological Data Inventory Folios (GDIFs) were completed for areas in the Patricia Mining Division. Of these, five have been published and seven are in press.

The GDIFs completed this year cover a number of areas in the Central Uchi belt, south Sturgeon Lake, Superior Junction area, and the Opapimiskan Lake area. An update of the Dona Lake area, one of the busiest areas in the Patricia Mining Division, will be released in 1989.

E. Young was employed periodically throughout 1988 as a data entry clerk for the GDIF Program. A total of 35 GDIFs are now stored on magnetic media and will be updated accordingly. For the remainder of 1988 and the beginning of 1989, emphasis will be on the North Caribou belt and the Savant Lake area.

TABLE 4.4. LIST OF GEOLOGICAL DATA INVENTORY FOLIOS.

AREA	NTS AREA	GDIF NO.
ACHAPI LAKE	52P/04NE	212
ATIKOKIWAM LAKE	52P/04NW	211
AUGUST LAKE	52P/04SE	216
BAGGY LAKE	520/12NE	IN PRESS
BECKINGTON LAKE	52J/02NE	355
BELL LAKE	52G/15SW	438
CALEY LAKE	520/07SE	326
CARON LAKE	520/01SE	214
COLLISHAW LAKE	52P/12NW	430
COUCHEEMOSKOG LAKE	520/08SE	276
DONA LAKE	520/08NE	279 (UPDATED IN PRESS)
DRUM LAKE	520/03NE	337
DUFFELL LAKE	520/02NW	338
ECHO TOWNSHIP	52F/16SW	318
FIRST LOON LAKE	52P/12SW	431
FOURBAY LAKE	52J/02SW	348
FRY LAKE	520/03NW	373
GREENBUSH LAKE	52J/16NE	218
JOHNSTON BAY	520/03SE	374
KAPKICHI LAKE	520/08NW	277
KAWASHE LAKE	520/06SE	324
LITTLE OCHIG LAKE	520/08SW	278
LOWRY LAKE	52P/04SW	215
MATAPESATAKUN BAY	520/02NE	339
MCAREE TP	52F/16SW	219
MCVICAR LAKE	520/11SW	IN PRESS
MEEN LAKE	520/06NW	IN PRESS
NABEMAKOSEKA LAKE	520/06SW	372
OSNABURGH LAKE	520/01NE	210
PASHKOKOGAN LAKE	52J/16NW	217
PENASSI LAKE	52G/14NE	IN PRESS
PONSFORD LAKE	520/09SW	274
PRESS LAKE	52G/14SW	IN PRESS
QUEST LAKE	52G/15NE	384
RIACH LAKE	520/01SW	213
SADDLE LAKE	520/11NW	IN PRESS
SHARRON LAKE	52J/04NE	IN PRESS
SIXMILE LAKE	52G/15NW	328
SKINNER LAKE	53B/09NW	IN PROGRESS
SMOCK LAKE	52G/13NE	319
SQUAW LAKE	52J/02SE	327
STOUGHTON LAKE	520/12SE	IN PRESS
TARP LAKE	520/09SE	275
VALORA LAKE	52G/14SE	439
WRIGHT LAKE	520/07SW	325
ZARN LAKE	52J/04SE	IN PRESS
ZEEMEL LAKE	53B/09SW	IN PRESS

The GDIF program is funded by COMDA. This year is the final year of a three–year program. Approximately 60 percent of the assessment files for the Sioux Lookout District were inventoried during this program, but less than 30 percent of the greenstone belt areas have been covered.

DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library provides core storage facilities for the Sioux Lookout Resident Geologist's District. Core stored consists of entire drillholes from both exploration and mine development drilling. Incomplete holes recovered from old drill sites, and short samples of core submitted for credit under Section 77 (6) of the Mining Act (RSO 1980) may also be stored. Some of the core has been relogged and sampled by drill core library staff.

Core collected in the Sioux Lookout District from December 1, 1987 to November 20, 1988, totaled 3613.0 m.

The current content of the library consists of 38 917.3 m of completely catalogued core stored inside the building of which 8785.4 m is from the Sioux Lookout District, and an additional 17 450.0 m, including 2874.0 m from the Sioux Lookout District, which is held in secure outdoor storage. The latter is the excess core from several drill projects that were collected in their entirety, core that has been culled from the system, and core remaining after some holes were relogged and reduced. This excess core is available for examination at a client's request.

TABLE 4.5. SUMMARY OF SIOUX LOOKOUT DISTRICT CORE IN THE LIBRARY.

AREA	NTS	COMPANY	HOLES
Beckington Lake	52J/02NE	Mine Lake Resources Ltd.	3
Bell Lake	52G/15SW	Minova Inc.	5
Conant Twp.	52J/07NE	Noranda Inc.	1
Connell Twp.	520/08NE 520/09SE	Gallant Gold Mines Ltd.	9
	520/09SE	Kerr-Addison Mines Ltd.	2
Coucheemoskog Lake	520/08SE	Power Explorations Inc.	9
Echo Twp.	52F/16NW	Braeswood Explorations Ltd.	3
	52F/16NW	Rio Tinto Canadian Expl.	3
Fourbay Lake	52J/02SW	Riverton Resources Corp.	3
Kecheokagan Lake	53B/02NW	Great Plains Dev. Co.	3
Nemeigusabins Lake	53H/12SW	Platinum Exploration Can.	9
Penassi Lake	52G/14NE	Noranda Inc.	1
Pickerel Twp.	52F/16NE	Quyta Gold Mines Ltd.	3
	52F/16NE	Realmont Mines	1
	52F/16NE	Tarbush Lode Mining Ltd.	4
Sixmile Lake	52G/15NW	Noranda Inc.	2
	52G/15NW	Santana Petroleum Corp.	4
Squaw Lake	52J/02SE	MPH Consulting Ltd.	1
Tarp Lake	520/09SE	Kerr-Addison Mines Ltd.	1
Zarn Lake	52J/04SE	Goldwinn Resources Ltd.	1

Use of the core library by industry and government personnel increased in 1988. A total of 109 visits were made by industry personnel; 44 were made by government personnel (both provincial and federal). Many of the visits by industry personnel to examine core lasted several days. A total of 83.5 man days were spent by industry geologists examining and logging drill core.

Much of the core in the library is from recent gold exploration. Emphasis has been placed on collecting core from the more remote parts of the area north and east of Sioux Lookout and from some of the old mines. A complete catalogue listing of non–confidential core may be obtained by contacting the Kenora Core Library or the Sioux Lookout Resident Geologist.

Core from a total of 73 drillholes in the Sioux Lookout District are stored in the main part of the collection with another 38 holes in outdoor storage; most of this core was drilled for gold. Table 4.5 summarizes the core in the collection.

The collection includes core from several older drill projects in the Sioux Lookout District; the Pidgeon molybdenum deposit in Echo Township, and gold properties in Echo and Pickerel townships near the Goldlund Mine and Camreco properties. Core has been obtained from International Platinum Corp.'s Big Trout Lake platinum exploration project; and several representative drillholes from the vicinity of the Mattabi and Lyon Lake massive sulphide deposits have been collected.

The core from the Pidgeon molybdenum deposit consists of holes through the mineralized zone of the intrusion and part of the host rock. Representative coverage of the mineralized zone has been obtained.

The Big Trout Lake gabbro has been explored for platinum group metals for several years and was drilled in 1985. Drill core from nine holes forms a section across some of the known mineralized zones.

The core from the Sturgeon Lake open pit lead–zinc deposit of Minnova Inc. comprises five holes through the orebody, illustrating the hanging wall, massive sulphide ore, and the footwall. This core is representative of a deposit that has been mined out. Core from drilling in this area by Noranda Inc. in the early 1970s also forms part of the collection.

Core from gold occurrences near Pickle Lake (Power Explorations Inc., Ateba Mines Inc., Kerr Addison Mines Limited, Central Patricia Explorations, and Gallant Gold Mines Ltd.) gives examples of the mineralization in this area.

PROPERTY EXAMINATIONS

THE NO. 1 ZONE, KARL–ZEEMEL GOLD PROSPECT

The No. 1 zone of the Karl–Zeemel gold prospect is a relatively new find in the North Caribou greenstone belt. It was discovered in 1987 on a exploration property under option to Power Explorations Inc. The property is located approximately 130 km by air, north–northeast of Pickle Lake. It is 4.5 km southeast of Placer Dome's East Bay development project (*see* Figure 4.3). A seasonal road from East Bay provides access to the property during the winter months. The only access at other times of the year is by air to Karl Lake, Zeemel Lake, or Graff Lake.

Harry Hodge and Brian Huston of Geocannex Limited, and A. Pryslak of BP Canada Inc. accompanied the junior author on the property visit and have contributed to the author's geological under-

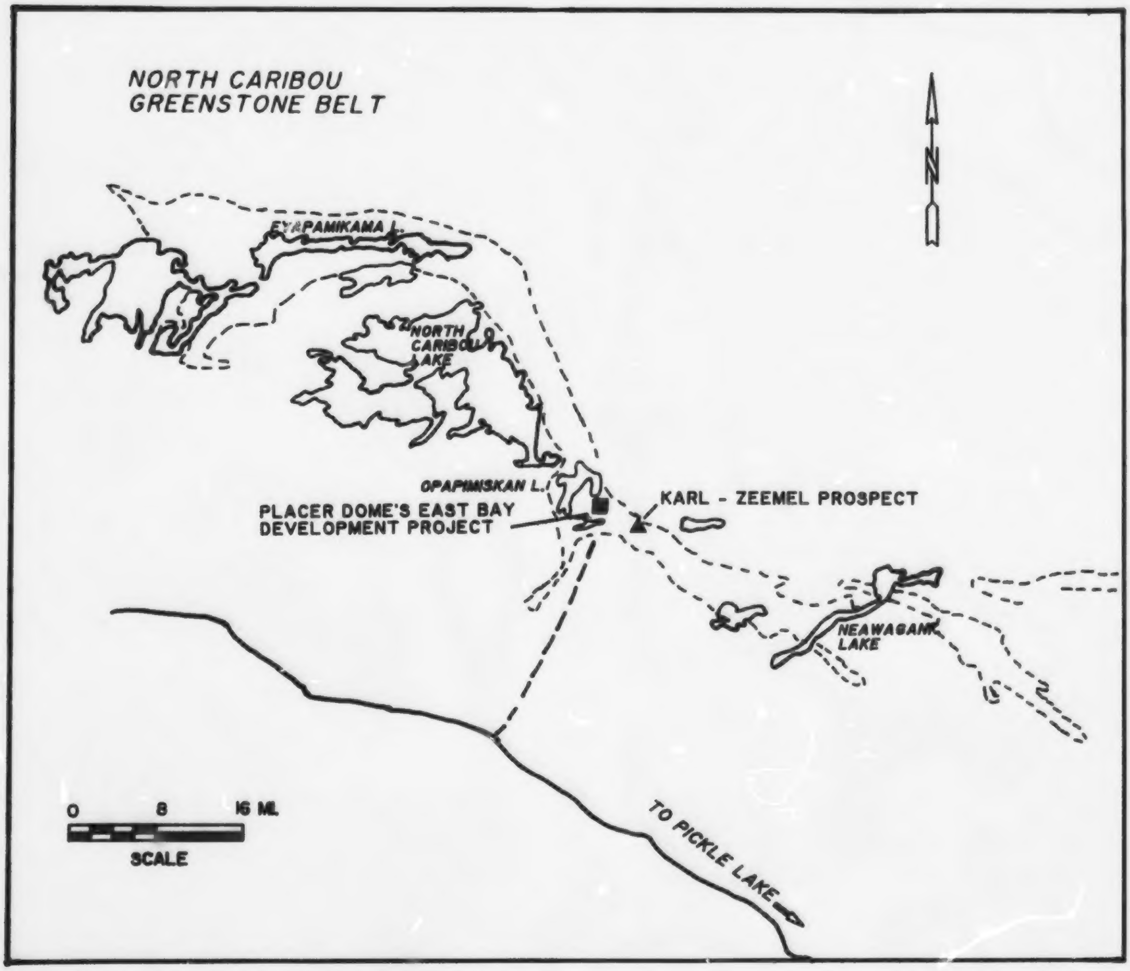

NORTH CARIBOU GREENSTONE BELT
N
EYAPAMIKAMA L.
NORTH CARIBOU LAKE
OPAPIMISKAN L.
PLACER DOME'S EAST BAY DEVELOPMENT PROJECT
KARL - ZEEMEL PROSPECT
NEAWAGANK LAKE
0
8
16 MI.
SCALE
TO PICKLE LAKE

Figure 4.3. *Location map for the Karl–Zeemel gold prospect.*

standing of the prospect. The author takes full responsibility for any errors or omissions in the report as it reflects his opinions and conclusions.

Exploration History

Gold was discovered in 1962 at Opapimiskan Lake by the Musselwhite brothers. This started a long period of gold exploration in the North Caribou greenstone belt. In 1984, Dome Mines Limited, operator for the Musselwhite Consortium announced drill-indicated mineral reserves of 3.2 million tons grading 0.169 ounce gold per ton (The Northern Miner, February 9, 1984, p.1). The Musselwhite Consortium proceeded with an underground exploration program. The program was less successful than anticipated.

While the underground exploration program was is progress, member companies of the Musselwhite Consortium staked and worked ground in the area. Inco Limited held a part of what is now the Karl–Zeemel Property. Geophysical and geological surveys were conducted and a few anomalous gold values were returned from lithogeochemical samples. Inco Limited did not follow up on the anomalous values. Their claims were allowed to lapse.

H. Hodge and associates restaked the Karl–Zeemel Property in 1985, and optioned the ground to Power Explorations Inc.

A grid with 400–foot (125 m) line spacing was cut over the property and magnetic, VLF, and geological surveys were conducted in 1986 and 1987. Many (600 to 800) grab and channel samples were sent for analysis and a large number returned anomalous gold values in the range of 100 to 13 000 ppb.

A 5250 m drill program, consisting of 45 holes, was carried out between the fall of 1987 and the winter of 1988. Of these drillholes, 25 tested the strike length of the No. 1 zone, which on surface consistently yielded values of 300 ppb gold or better; the best value from surface sampling was 13 100 ppb gold (0.382 ounce gold per ton). The other 20 drillholes tested various other geophysical and geochemical anomalies on the property.

Regional Geology

The Opapimiskan Lake area was mapped by Satterly (1941). The area was recently remapped by Breaks *et al.* (1987).

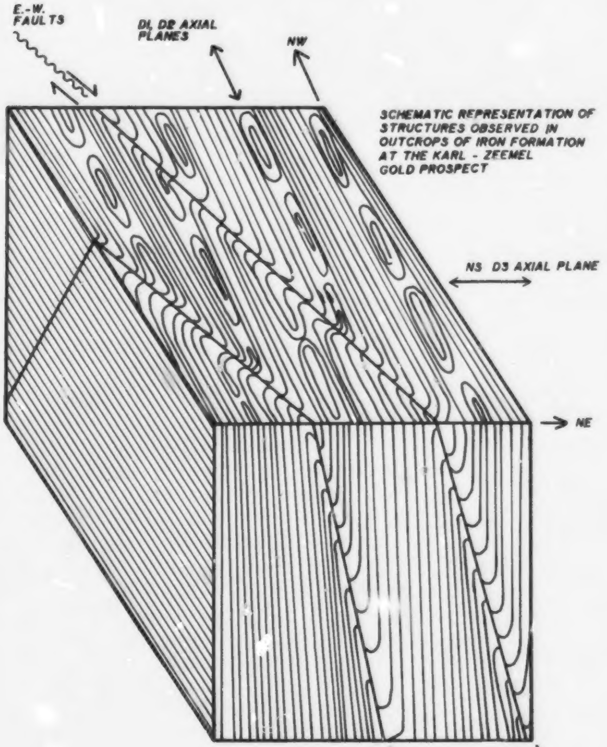

E.-W. FAULTS
D1, D2 AXIAL PLANES
NW
SCHEMATIC REPRESENTATION OF STRUCTURES OBSERVED IN OUTCROPS OF IRON FORMATION AT THE KARL - ZEEMEL GOLD PROSPECT
NS D3 AXIAL PLANE
NE

Figure 4.4. *Structures in the iron formation at the Karl–Zeemel gold prospect.*

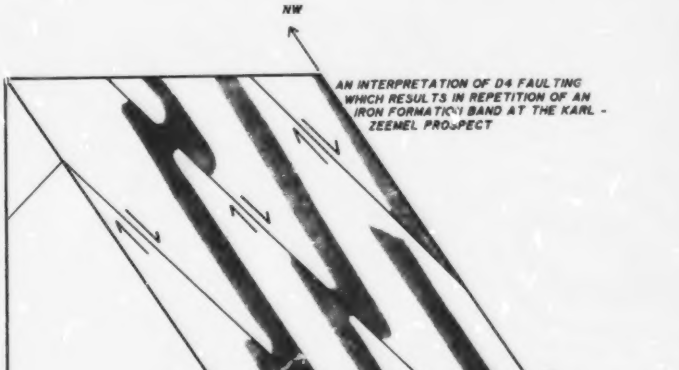

NW
AN INTERPRETATION OF D4 FAULTING WHICH RESULTS IN REPETITION OF AN IRON FORMATION BAND AT THE KARL - ZEEMEL PROSPECT
NE
INTERSECTION
DIAMOND DRILL HOLE PROJECTIONS

Figure 4.5. *Possible repetition of the iron formation horizon at the Karl–Zeemel gold prospect.*

The North Caribou greenstone belt is, in general terms, a 120 km long synclinorium, averaging 6.5 km from outside limb to outside limb. A complex basin-and-dome, fold interference pattern is developed around Opapimiskan Lake, where the greenstone belt is sandwiched between three granitoid plutons.

The geology of the synclinorium consists of predominantly mafic metavolcanics flanking a core of clastic metasediments. Chemical metasediments (iron formation) occur within both the metavolcanics and the metasediments, but are more prevalent near the contact of the two lithotypes. Both silicate– and oxide–facies iron formation occur throughout the belt. Horizons of ultramafic metavolcanics are found within the mafic metavolcanics.

Property Geology

The Karl–Zeemel gold prospect is situated in the southeast–trending part of the North Caribou greenstone belt, between Opapimiskan Lake and Neawagank Lake (*see* Figure 4.3). The geology is typical of the belt, with mafic metavolcanics flanking clastic metasediments. Anomalous gold mineralization is found both in the metavolcanic and the metasedimentary environments. The No. 1 zone, which may have the potential to be a mineable gold deposit, is on the northern limb of the synclinorium. The zone occurs in the northern most of three iron–formation bands. It has been outlined along strike for more than 400 m.

The structural setting of the gold mineralization is very complex. The D1 and D2 deformation events served to bring stratigraphy to its present upright, isoclinally folded position. Individual beds dip 70° south to 90°. Interbeds of mafic metavolcanics in the iron formation are boudinaged. This demonstrates that deformational events were, in part, tensional.

Undulating, gently plunging cross folds were produced by the D3 event, which was compressional along the long axis of the greenstone belt. On the present erosional surface, the cross folds are expressed as small, elongate basins and domes (long axis to short axis ratio 20:1) in the iron formation, and as alternating zones of crenulation and axial planar fractures in the mafic metavolcanics. The wave length of the minor cross folds ranges from 6 to 15 m. The wavelength of the major cross folds was not determined.

The fourth deformational event (D4), which was also compressional, resulted in east–trending micro–faulting at a 20 to 30 degree angle to regional foliation and bedding in the iron formation. Drag folds indicate that the faulting had normal dip–slip movement and right–handed strike–slip movement. Faults which cut interbedded iron formation and mafic metavolcanics show brittle failure, and refraction of the fault plane between layers. This is probably due to ductility contrasts. Faults which cut only iron formation have associated drag folds on either side of the fault plane. This is viewed as a more ductile feature.

Figure 4.4 illustrates the relationship between the faulting and the folding as observed in outcrop. A possible implication of the D4 faulting is that the three iron–formation bands may actually be one horizon repeated by faulting (Figure 4.5).

Alteration associated with the gold mineralization in the iron formation extends approximately 2 m into the mafic metavolcanics on the northern side of the No. 1 zone. The alteration consist of minor, disseminated, brown biotite, and quartz–filled tension gashes. The wall rock to the tension gashes is bleached. The brown biotite is possibly indicative of potassium metasomatism. There is no apparent alteration on the south wall of the mineralized zone. The host iron formation is silicified and contains secondary sulphides, mostly pyrrhotite, and grunerite.

Assay results for samples of the host iron formation are consistently anomalous in gold. The concentration of the gold appears to be directly proportional to the concentration of replacement pyrrhotite in the sample. The concentration of the replacement pyrrhotite locally exceeds 50 percent.

Power Explorations Inc. is encouraged by the results to date and further drilling on the No. 1 zone and other zones of anomalous gold mineralization on the property is planned (H. Hodge, Geocannex Limited, personal communication, December 1988).

THE KASAGIMINNIS LAKE GOLD PROSPECT

In the April 18, 1988 edition of The Northern Miner (p.11) Power Explorations Inc. published preliminary "...mineral reserves" of 2.9 million tons grading 0.14 ounce gold per ton for their recently discovered Kasagiminnis Lake Prospect. Included in the mineral reserves are 1.1 million tons grading 0.19 ounce gold per ton.

Kasagiminnis Lake is located 26 km south–southwest of the town of Pickle Lake. The prospect is situated on the peninsula between the two north-east–trending arms of Kasagiminnis Lake (*see* Figure 4.6). The prospect is approximately 10 km east of Lac Mineral Ltd.'s Hasaga Deposit (originally known as the Koval–Ohman).

Kasagiminnis Lake may be reached by canoe or snowmobile, travelling west from Highway 599 along a series of lakes, streams, and portages. Kasagiminnis Lake is often too shallow for float–equipped aircraft.

The junior author accompanied R. Higginson of Geocannex Limited and A. Pryslak of BP Canada Inc. on a visit to the Kasagiminnis Lake Property. R. Higginson, who has logged most of the diamond–drill holes on the property, conducted the tour. The author acknowledges contributions made by R. Higginson and A. Pryslak to his understanding of the Kasagiminnis Lake Prospect, but takes full responsibility for any errors or omissions made in this report.

The Kasagiminnis Lake area was examined in the early 1970s by Umex Inc. while searching for base metals. Umex Inc. flew a geophysical survey over the area, and drill tested two anomalies on the present Kasagiminnis Lake Property.

Moss Resources Ltd. staked the Kasagiminnis Lake Property in 1984. VLF and magnetometer surveys were flown over the property in 1985. Linecutting, geology, and ground geophysics follow–up led to the discovery of a folded quartz vein that assayed 0.25 ounce gold per ton over 1.86 m. In 1986, Moss Resources Ltd. entered a joint venture agreement on the property with Power Explorations Inc. More detailed geological mapping was carried out prior to conducting 3727 m of diamond drilling during the 1986–87 winter drilling season. A gold zone was discovered by the drilling to the north of the auriferous quartz vein. Another 5991 m of diamond drilling was done in the 1987–88 winter drilling season.

Regional Geology

Sage and Breaks (1982), and Stott *et al.* (in press) have mapped the geology in the Kasagiminnis Lake area.

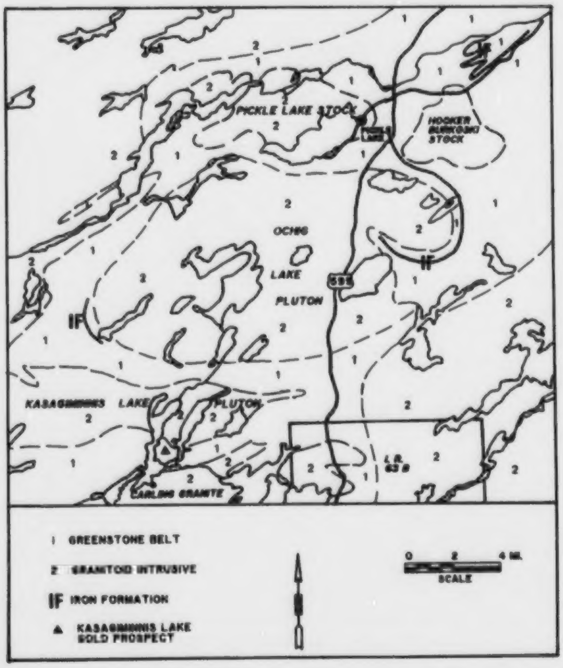


Figure 4.6. *Location map for the Kasagiminnis Lake gold prospect.*

The Kasagiminnis Lake Prospect is situated within a 1.6 km wide east–trending segment of greenstone belt sandwiched between the Kasagiminnis Lake Pluton to the north and the Carling Lake Batholith to the south. The segment of greenstone belt consists of a sequence of south–facing, slightly overturned, mafic metavolcanic flows interlayered with mafic to felsic pyroclastics, metasediments, and lean oxide–facies iron formation with possible local silicate–facies iron formation. Gabbroic amphibolites, pegmatites, and the occasional felsic dike are intrusive to the volcanic–sedimentary sequence.

The internal structure of the segment of greenstone belt is not well understood, due to a scarcity of outcrop. Faults can be interpreted from magnetic surveys, and a few of these interpretations have been supported by mylonites and fault breccias intersected by diamond drilling. The faults trend northeast and northwest, and are possibly a conjugate fracture system developed in response to the compressional forces set up by the intrusion of the surrounding granitoid plutons. North–trending faults, perpendicular to the strike of the greenstones, are also suggested by magnetic surveys.

Deposit Geology

The deposit geology, due to the scarcity of outcrop, is interpreted for the most part from diamond–drill core. The rock sequence through the gold deposit from the hanging wall on the north to the footwall on the south, is as follows:

1. Interlayered mafic metavolcanics and felsic pyroclastics
2. Intermediate to felsic tuffs and crystal tuffs
3. Mafic metavolcanic tuff and (or) amphibolite
4. The mineralized zone
5. Footwall quartz–carbonate veinlet zone
6. Footwall mafic metavolcanics

INTERMEDIATE TO FELSIC TUFFS AND CRYSTAL TUFFS

The hanging wall unit is identified as a fine–grained dacite to rhyodacite tuff. Silicification (bleaching) and sericitization make the unit appear rhyolitic. The intensity of shearing within this unit is variable, as is the degree of alteration. A characteristic of this unit is the presence of minor, disseminated, red biotite. It is presumably a by–product of a potassium metasomatism. Only minor, barren sulphide is found in this unit.

MAFIC METAVOLCANIC TUFF AND (OR) AMPHIBOLITE

This unit may be a sill–like intrusion, or a thin mafic tuff. It exhibits a uniform, weak to moderately sheared, fine– to medium–grained crystalloblastic texture, and contains 1 to 3 percent fine, disseminated, acicular magnetite. The unit grades into the mineralized zone where it is interlayered with lean chert–magnetite iron formation. The unit is auriferous where the magnetite is replaced by pyrrhotite. Magnetite and pyrrhotite are mutually exclusive of one another.

THE MINERALIZED ZONE

The mineralized zone is a 10 to 13 m wide interval of mafic metavolcanic tuffs interlayered with lean iron formation. The zone is sheared and silicified, and contains varying concentrations of secondary pyrrhotite. It is commonly garnetiferous. The gold content appears to be directly related to the pyrrhotite concentration, which varies from 1 to 5 percent, but is locally greater than 50 percent of the rock. The pyrrhotite is disseminated and has a feathery texture. Occasional quartz–carbonate veinlets, rimmed by amphibole and grunerite, also carry gold. A few specks of visible gold have been observed along the the veinlet contacts. Grunerite is common throughout the mineralized section.

FOOTWALL QUARTZ–CARBONATE VEINLET ZONE

This zone usually occurs within mafic metavolcanics, but locally incorporates minor iron formation. The quartz–calcite veinlets are similar to those that carry gold in the mineralized zone. The footwall zone contains minor, secondary pyrrhotite and subeconomic concentrations of gold.

FOOTWALL MAFIC METAVOLCANICS

These are tuffs and (or) flows, which appear to be similar to the mafic metavolcanic tuffs and (or) amphibolites of the hanging wall rocks, are foliated with a fine– to medium–grained crystalloblastic texture, but are otherwise featureless. To date, 25 diamond–drill holes have intersected the mineralized zone. Power Explorations Inc. is very encouraged by the assay results and expects to do more definition drilling on the mineralized zone in the winter of 1988–89 (John Adams, Geocannex Limited, personal communication, September 1988).

GOLD OCCURRENCES IN THE MCVICAR LAKE AREA

Introduction

The Geological Data Inventory Folio for the McVicar Lake area was compiled January 1988 (*see* Figure 4.7). The location of the McVicar Lake South gold occurrence was difficult to plot because various published maps of the area gave different locations. The assessment files listed as references for the occurrence in the Source Mineral Deposit Records also indicate different locations for the occurrence. One assessment file submitted by Chellow Gold Mines Ltd., in 1950, contains a geological map by M. Watts that indicates 10 different occurrences of gold in the south McVicar Lake area, but gives no assays (Assessment Files, Ministry of Northern Development and Mines (MNDM), Sioux Lookout, File No. 52O/11SW 0038–C1). A field trip was undertaken in the summer of 1988 to verify the gold occurrences on M. Watts' map and to determine the location(s) of the McVicar Lake South gold occurrence.

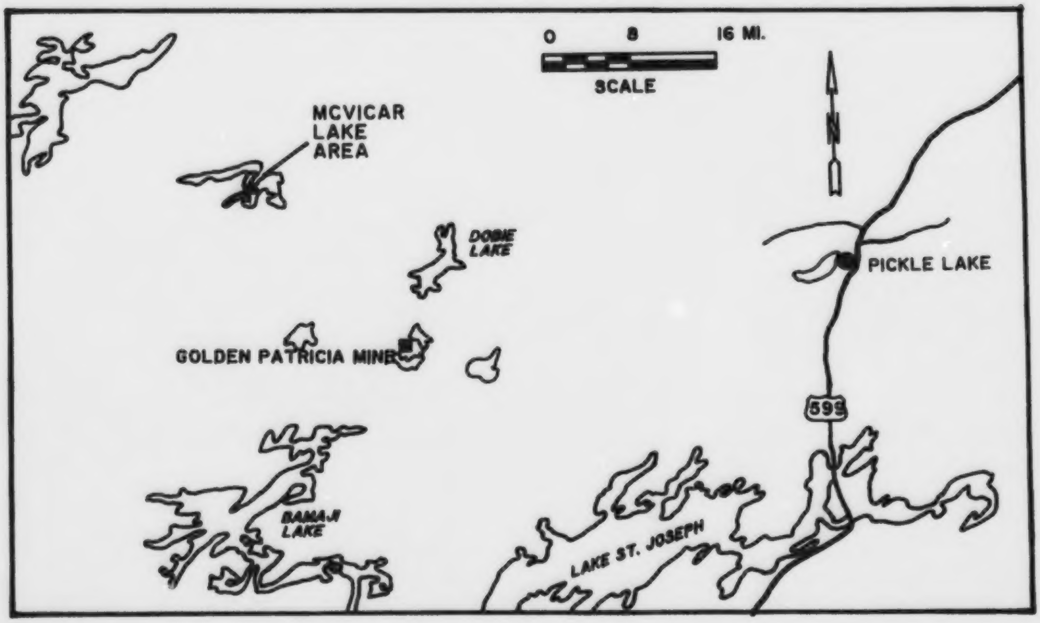


Figure 4.7. *Location map for the McVicar Lake area.*

Exploration History

Gold mineralization was discovered in 1928 by two prospectors, Bill Smith and Stanley Watson, on an isthmus of land between Shonia Lake and McVicar Lake. The announcement of the discovery sparked a small staking rush in the area. The Smith–Watson Occurrence was optioned to Northern Aerial Minerals Exploration Ltd. Clearing, trenching, and sampling around the showings was done during the winter of 1928 and the spring of 1929. The results were disappointing.

Prospecting activity in the area decreased in the early 1930s, and little mineral exploration was done in the area for several years.

Exploration activity in the McVicar Lake area picked up again in 1950. Chellow Gold Mines Ltd. staked and worked a large claim block in the south–central part of McVicar Lake. The geological map by M. Watts, mentioned above, was prepared from this work. Some diamond drilling was also performed by Chellow Gold Mines Ltd. (Assessment Files, MNDM, Sioux Lookout, File No. 52O/11SW 0039–A1).

In 1954, W.F. Morrison drilled three diamond-drill holes, totaling 1126 feet, at the northeastern end of Semia Lake, south of McVicar Lake.

A long period of base–metal exploration in the McVicar Lake area started in 1959. Kenlew Mines Ltd. explored several claim groups in the area. In the progress of this work, a diamond–drill hole intersected a narrow quartz vein containing visible gold. The drillhole was spotted near four of M. Watts' gold occurrences, south of McVicar Lake. The diamond–drill log was submitted for assessment credits (Assessment Files, MNDM, Sioux Lookout, File No. 52O/11SW 0013–A1).

Base–metal exploration in the McVicar Lake area continued until the late 1970s. Several small base–metal occurrences were discovered, though none proved to be economically significant.

A period of intense exploration for gold started in 1984, after the discovery of the Golden Patricia gold deposit at Muskegsagagen Lake to the southeast of McVicar Lake. Recent exploration has focused both on the re–evaluation of old occurrences and on the discovery of new mineralization.

Regional Geology

The geology of the McVicar Lake–Shonia Lake area was first mapped by Laird (1931), following the staking rush of 1928. Emslie (1960) did reconnaissance surveys in the area for the Geological Survey of Canada. Fenwick (1971) mapped the area for the Ontario Department of Mines.

The McVicar Lake area is underlain by a bimodal metavolcanic succession in the eastern part. Mafic lavas and tuffs underlie most of the area. Intermediate to felsic lavas and pyroclastics are found in isolated pods to the north, around Boyes Lake, and in a flattened "C"–shaped structure around McVicar Lake. Intermediate to felsic metavolcanics are also found as isolated pods along a tail of greenstone to the southeast of McVicar Lake.

A gabbro–diorite sill or stock intruded the metavolcanics along the southern side of McVicar Lake. The gabbro–diorite intrusion is elongate in an westerly direction, but a tongue of the intrusion extends north to Shonia Lake.

Both the metavolcanic succession and the gabbro–diorite intrusion are cut by a tongue of quartz monzonite to trondhjemite from a large granitoid pluton to the south of the McVicar Lake metavolcanic belt.

Field Examinations

As mentioned previously, the purpose of the McVicar Lake field visit was to locate and document the McVicar Lake South gold occurrence(s). The map by M. Watts in the assessment files indicates ten gold occurrences; two are shown to be float material, leaving eight with bedrock sources. The occurrences are discussed in numerical order.

OCCURRENCES NO. 1, 2, AND 3

The first three occurrences are indicated as within 150 m of the southern shoreline of the central narrows of McVicar Lake. Two trenches, 15 to 30 m in length, were found in a location corresponding to Occurrence No. 1 (*see* Figure 4.8, No. 1). Both trenches are overgrown with alders and small balsam. The walls of the trenches are completely slumped. The trenches trend west and are about 100 feet apart. The only bedrock exposed was at the western end of the south trench where the rock type was identified as quartz monzonite.

Occurrences No. 2 and No. 3 (*see* Figure 4.8, No. 2 and No. 3) were not located, though outcrop in the area was moderately abundant. Fenwick (1971) indicated the area around the two occurrences as being underlain by quartz monzonite. However, a fine–grained felsic rock was observed in approximately half the exposures in the area. The junior author interprets this felsic rock to be a metavolcanic. The interpretation is based on comparison with other felsic metavolcanics mapped by Fenwick (1971), which outcrop nearby. The contact relationship between the two rock types was not determined. Two possibilities are: rafts of felsic metavolcanic in the quartz monzonite intrusion, or sheet dikes of quartz monzonite intruding the felsic metavolcanics. A shoreline outcrop to the northwest of the supposed location of No. 2 and No. 3 occurrences exposes mafic metavolcanics in contact with felsic metavolcanics; both are cut by quartz monzonite dikes.

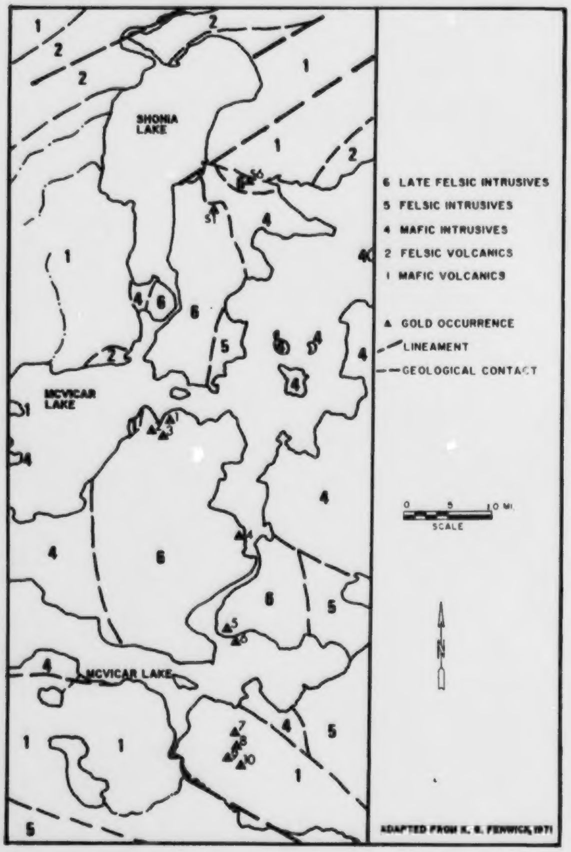
OCCURRENCE NO. 4

This occurrence is located on the western shore at the northern end of the channel to the southern part of McVicar Lake (*see* Figure 4.8, No. 4). The occurrence, which is underlain by quartz monzonite, is near the contact with the gabbro–diorite intrusion. Fenwick (1971) marked a trench in the location of the occurrence, though gold mineralization is not noted. A VLF anomaly is associated with the quartz monzonite–gabbro contact.

OCCURRENCE NO. 5

Occurrence No. 5 is located on the northern shore of the southern part of McVicar Lake on the eastern side of the channel leading to the northern part of the lake (*see* Figure 4.8, No. 5). A narrow trench, extending perpendicular to the shore for approximately 15 m, was recently hydraulically stripped and channel sampled with a rock saw. Quartz diorite is exposed for the length of the trench.

Quartz veins striking 350° and dipping 65° east have filled tension gashes in the quartz diorite. The largest quartz vein is at the northern end of the trench. It is exposed for 3.5 m and has a width of up to 0.6 m. The quartz is white, and barren of sulphide. Chlorite seams occur in some of the quartz veins. Grab samples of the quartz vein material and the quartz diorite were analyzed for gold at the Geoscience Laboratories, Ontario Geological Survey, Toronto, and returned results of less than 2 ppb.



ADAPTED FROM K. B. FENWICK, 1971

Figure 4.8. *Location map for gold occurrences in the McVicar Lake area.*

OCCURRENCE NO. 6

This is a float occurrence in shallow water, southeast of Occurrence No. 5 (*see* Figure 4.8, No. 6).

OCCURRENCES NO. 7, 8, 9, AND 10

M. Watts' map indicates four gold occurrences south of the southern part of McVicar Lake, and northeast of Semia Creek.

Occurrence No. 7 is the most northerly and is indicated as float (*see* Figure 4.8, No. 7).

A traverse south from McVicar Lake led to an old, overgrown trench corresponding to Occurrence No. 8 (*see* Figure 4.8, No. 8). The trench is on the western side of a large outcrop area. Stripping of the trench and outcrop revealed the occurrence to be associated with a contact breccia zone between the quartz diorite and mafic to intermediate metavolcanics. Up to 1 percent pyrrhotite is disseminated through the breccia. A 2.5 to 5.0 cm white quartz vein trends 140° across the outcrop. A 20 cm chip sample along the vein assayed 1730 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto). No gold mineralization or quartz vein was found in the trench. A grab sample of the contact breccia assayed less than 2 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto). Approximately 30 m to the west of the trench is an outcrop of mafic to intermediate metavolcanics that are moderately to strongly sheared. The shearing strikes 125° and dips 70° northeast. A secondary fracture cleavage strikes 140° and dips vertically; this is parallel to the quartz vein to the east.

Traversing farther south led to a trench corresponding to Occurrence No. 9 (*see* Figure 4.8, No. 9). The trench and adjacent outcrop were partly stripped and contact breccia, similar to Occurrence No. 8, was exposed. No veining was uncovered. A grab sample of the contact breccia assayed less than 2 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto). Occurrence No. 10 is supposedly located to the east of Occurrence No. 9 (*see* Figure 4.8, No. 10), but a search of the area found no trenches, mineralized outcroppings, or quartz veins.

Only four of the ten gold occurrences indicated on M. Watts' geological map were located in the field, and at only one of the four occurrences was gold mineralization confirmed. More detailed mapping in the area of the occurrences, as well as better sampling of the trenches, is needed before the area can be properly assessed.

As for determining a proper location for the McVicar Lake South gold occurrence, either the location of Occurrence No. 8, or the location of Kenlew Mine Ltd.'s drillhole that intersected visible gold, may be used.

SHONIA LAKE GOLD OCCURRENCES

The Shonia Lake gold occurrences are those discovered by Smith and Watson in 1928. The original names of the occurrences are the North or No. 6 showing and the No. 1 showing (*see* Figure 4.8, No. S6 and No. S1). Both showings are hosted by foliated porphyritic quartz monzonite and both contain quartz–sulphide mineralization. The showings differ in that the No. 1 showing consists of a series of subparallel quartz–sulphide–filled tension gashes, while the No. 6 showing is a distinct vein approximately 45 m in length.

After the initial examination of the showings in 1928–29, work on the showings ceased. In 1959, Castlebar Silver and Cobalt Mines Ltd. staked a 12–claim property covering some airborne geophysical anomalies. The 12 claims covered the gold showings. Geophysical surveys were conducted to locate the airborne anomalies on surface. A subsequent diamond drilling program intersected a 30 cm zone of mineralization that assayed 0.13 ounce gold per ton. It is not known, however, if the drillhole tested one of the original showings (Mineral Deposit Inventory Record No. KP0260). The claims were allowed to lapse. In 1972, a large claim block that also covered the showings was staked by The Hanna Mining Co., which did not report work on the showings.

Noranda Exploration Company, Limited staked a claim group to cover the showings in 1983, and conducted geophysical and geological surveys in 1984. Most of the original trenches were relocated by Noranda Exploration (Company, Limited) personnel.

No. 6 Showing

The No. 6 showing is located 150 m east of the shore of Shonia Lake as indicated on Figure 4.8 (Occurrence No. S6). The showing consists of one main quartz vein that trends 095° along the northern side of an outcrop ridge. Several narrow quartz veins, trending 075°, splay off the main vein into the host granite. The dip of the main vein varies from 70° north to 70° south. The narrow quartz veins which splay off the main vein dip 70° south. The main vein pinches and swells from 6 cm to over 1 m. It is exposed for 45 m, pinching off in a shear to the east and disappearing under overburden to the west. The minor sulphide mineralization associated with the No. 6 showing consists of coarse pyrite disseminated in the wall rocks and in fractures within the vein.

Four samples were taken and assayed for gold at the Geoscience Laboratories, Ontario Geological Survey, Toronto. The results are as follows:

Sample No.	Description	Assay Value
GWS–88–41	48" chip across the main vein	260 ppb Au
GWS–88–42	grab of wall rock beside the main vein	2 ppb Au
GWS–88–43	grab of quartz filled tension gash	6 ppb Au
GWS–88–44	grab of altered monzonite 15 m from vein	<2 ppb Au

Laird (1931) reported that a value of $8.60 gold per ton over 3 feet was the highest value received from the original working of the No. 6 showing. Other samples reportedly gave negligible values. Gold, in 1930, was valued at approximately $20.00 per ounce.

No. 1 Showing

The No. 1 showing is located approximately 150 m south of the No. 6 showing. The No. 1 showing consists of a stockwork of quartz–sulphide–filled tension gashes in an altered quartz monzonite. Most of the tension gashes trend 035° and dip 60° to the southeast. Other veins connect the tension gashes, but have a more random orientation. The individual veins can only be traced 5 to 6 m. The whole mineralized zone can be traced along the southern side of an west–trending hill for approximately 60 m.

Laird (1931) described the No. 1 showing as follows:

> "The gold occurs in a stockwork of quartz veins in a hydrothermally altered granite. The veins range from half an inch to 2 feet in width, trend in a northeast direction, and dip steeply to the south. A lamprophyre dike 15 feet wide strikes across the hill at North 55° East cutting off the veins sharply. Smaller parallel basic dikes stand close by. The altered granite grades into a fresh–looking pink granite that has been described above.
>
> The minerals commonly associated with the gold are coarse pyrite, chalcopyrite, ankerite, limonite, arsenopyrite, and galena, in order of decreasing abundance. They usually follow small fracture planes in the quartz, but they also disseminated in the altered granite. The gold is likewise found in the altered granite as well as in the quartz, although the values are more often higher in the quartz."

The hydrothermal alteration of the quartz monzonite includes sausseritization, silicification, carbonatization, and sulphidization. Iron carbonate and sulphide mineralization is limited to the quartz–filled tension gashes and to the wall rock immediately adjacent to the tension gashes. Silicification, most intense and pervasive beside the tension gashes, affects the monzonite for some distance from tension gashes. Sausseritization of feldspars is the most widespread alteration and is observed in most of the hillside outcrops of quartz monzonite.

Four grab samples were taken from the No. 1 showing and analyzed for gold at the Geoscience Laboratories, Ontario Geological Survey, Toronto. The results are as follows:

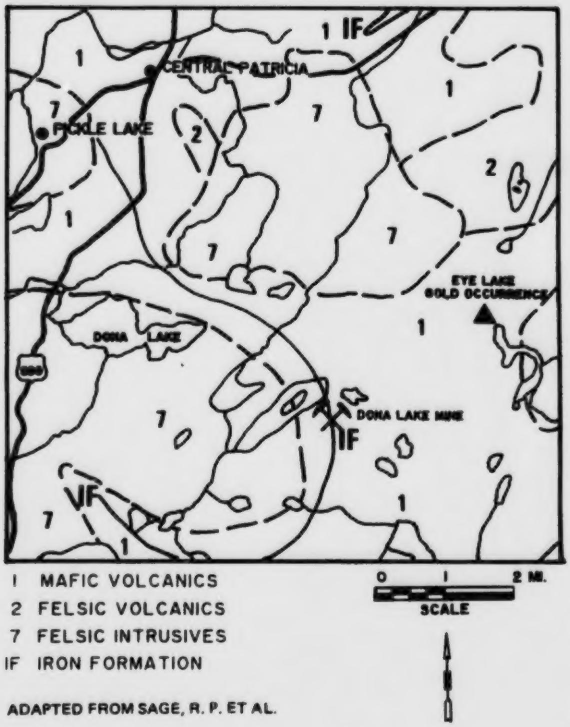
Sample No.	Description	Assay value
GWS 88-45	quartz vein material	35 ppb Au
GWS 88-46	silicified wall rock with some quartz vein and disseminated pyrite	10 ppb Au
GWS 88-47	wall rock with massive sulphides	3750 ppb Au
GWS 88-48	silicified and carbonatized wall rock	13 ppb Au

The Shonia Lake gold showings provide evidence for a gold-depositing hydrothermal system in the area. Present and past assay results indicated an erratic gold distribution associated with the sulphide-rich zones. These zones have limited areal extent.

EYE LAKE GOLD OCCURRENCE

The Eye Lake gold occurrence is situated approximately 15 km southeast of Pickle Lake and 5.5 km northeast of the Dona Lake Mine (*see* Figure 4.9). The occurrence is 400 m northwest of a lake locally known as Eye Lake. A series of diamond-drill roads leads northeast from the Dona Lake mine site to the occurrence.

Prior to 1984, two trenches were excavated on what is now known as the Eye Lake gold occurrence. In 1984, 31 claims were staked for Van Horne Gold Exploration Inc. in response to the discovery of the Dona Lake gold deposit. Contracts were then let for linecutting, geophysics, and geology. The occurrence was rediscovered during the geological mapping of the Van Horne Property. Twenty-eight claims were added to the property in 1986. Power Explorations Inc. then optioned both claim groups. More geological and geophysical work followed in 1987. A nine-hole, 928 m diamond drilling program was completed by the spring of 1988.



ADAPTED FROM SAGE, R. P. ET AL.

Figure 4.9. *Location map for the Eye Lake gold occurrence.*

The gold occurrence is located east of the Ochig Lake Pluton in a north-trending segment of the Pickle Lake greenstone belt. It is contained within a mafic metavolcanic succession that to the east is in contact with banded granitic gneisses. Geologists working for Geocanex Limited suggest a northeast-trending fault contact separates the mafic metavolcanics and the gneisses . The mafic metavolcanic succession is made up of pillowed and massive flow basalts with minor interflow tuffs and banded chert-magnetite iron formation . However, there is no known iron formation in the vicinity of the occurrence. The mineralogy of the mafic metavolcanics reflect greenschist facies metamorphism. The mafic metavolcanics are reportedly more intermediate in composition nearer the contact with the banded gneisses. This may be due to fault-related shearing and associated hydrothermal alteration.

The occurrence is contained within a north- to northeast-trending deformation zone (DZ) on the eastern side of the fault contact between mafic metavolcanics and gneisses. The DZ is of unknown width, but it is traceable both north and south for considerable distance. It is sub-parallel to a north-trending fault that cuts the Dona Lake Deposit. Displacements on micro-faults within the DZ suggest a left-handed sense of movement. The intensity of shearing within the DZ is variable. Most of the rock in the DZ has a very pronounced foliation, but a few narrow zones of intensely sheared chloritic schist are observed in the outcrops that host the occurrence. The zones of chloritic schist strike parallel to the deformation zone and dip 85° east. A lineation in the plane of the shear plunges 60° to 70° to the southeast. The zones of chloritic schist often contain lenticular pods of white quartz, and reddish-brown weathering, iron carbonate. The iron carbonate is also found disseminated through the chloritic schists. Low concentrations of pyrrhotite are found as stringers in the quartz-carbonate pods and as disseminations in the chloritic schists.

Only one of the zones of chloritic schist is known to contain significant concentrations of gold. The zone is approximately 41 cm wide. Two grab samples collected by Geocanex personnel from the zone assayed 0.206 ounce gold per ton and 0.093 ounce gold per ton (North 1984). A 41 cm chip sample taken from this zone by the junior author returned 4730 ppb gold (0.14 ounce gold per ton).

Two white quartz veins, of up to 1.2 m in width, occur in the outcrops hosting the occurrence. They are not known to carry gold and contain no sulphide mineralization.

The Eye Lake gold occurrence indicates that hydrothermal fluid capable of depositing gold probably passed through the deformation zone. A significant deposit of gold mineralization may occur elsewhere along the length of the deformation zone.

HOUGHTON CREEK GOLD OCCURRENCE

The Houghton Creek gold occurrence is a new discovery in the Savant Lake area. It is located approximately 8.5 km west of the junction of Highway 519 (Marchington Lake Road) and Highway 599, north of the village of Savant Lake. A gravel road leads north off of Highway 519 into a gravel pit just west of Houghton Creek. The occurrence outcrops in the gravel pit (*see* Figure 4.10).

Fifty-five unpatented mining claims have been staked to cover the gold occurrence and its possible extensions. The mining claims belong to Allan Best of Savant Lake.

There is no record in the Sioux Lookout Resident Geologist Office Assessment Files of previous exploration work around the occurrence. Bond (1980) mapped the geology of the Houghton Lake–Hough Lake area.

The Houghton Creek gold occurrence is located within the Hough Lake Stock, which is an elongate body of biotite granodiorite, roughly concordant with the regional stratigraphy. The granodiorite is massive, to weakly foliated sub-parallel to the regional east-trending foliation. Unaltered granodiorite outcrops near the gold occurrence. It contains up to 25 percent biotite and has many xenolithic inclusions.

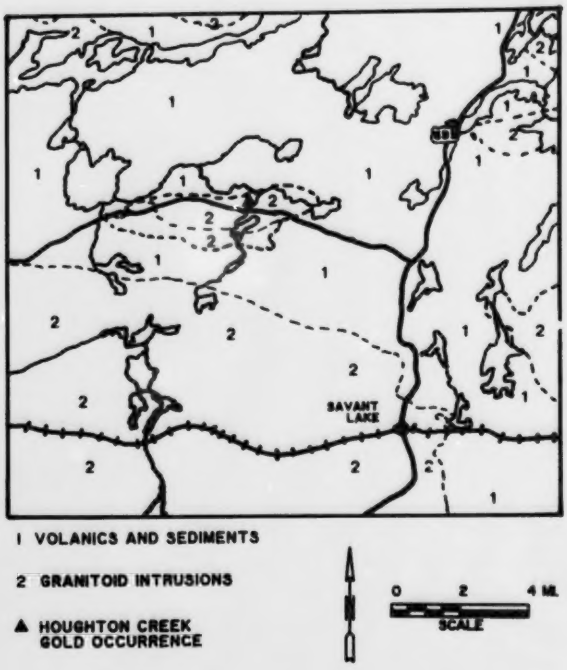


Figure 4.10. *Location map for the Houghton Creek gold occurrence.*

The gold occurrence is hosted by a set of anastomosing shear zones trending 060°. The aggregate width of the shear zones is at least 25 m and probably more than 30 m. The shear zones dip nearly vertically. A steep, southwest-plunging mineral lineation indicates the shearing had a strong vertical component. The sheared rock is now a quartz–biotite–sericite–sulphide schist. Contorted quartz–sulphide lenses cut the shear zones. Blocks of variably altered and sheared, biotite granodiorite are found between the shear zones. These blocks contain lenses of quartz, but no visible sulphides. The quartz lenses appear to be randomly oriented with respect to the shear direction. Minor pyrite is disseminated through the variably altered and sheared biotite granodiorite.

The sulphide species associated with the shears and mineralized quartz veins are, in decreasing order of abundance, pyrite, chalcopyrite, sphalerite, and galena. A. Best (personal communication, October 1988) reported that the mineralized shears and the mineralized quartz veins yield significant gold values. No visible gold has been observed.

The mineralized shear zones are traceable, with geophysics, between two trenches which are 200 m apart and for some distance beyond the trenches.

Twelve semicontinuous chip samples averaging 1.5 m in length were taken from the north trench during the property examination. A few selected grab samples were taken for reference and assay. The assay results were still pending at the time of writing.

EAST BAY GOLD OCCURRENCES

The East Bay gold occurrences were rediscovered by Stan Johnson prior to 1981. The East Bay of Sturgeon Lake is located 75 km northeast of Ignace on Hwy. 17 (*see* Figure 4.11). Moore (1911) marked the veins with trench symbols on his map of the Sturgeon Lake Goldfield. An Ontario Department of Mines compilation map (Davies *et al.* 1970) shows a gold occurrence symbol in the area south of McEdwards Lake. However, a more recent compilation map (Davies *et al.* 1980) does not show the vein, trench, or a gold occurrence symbol for this prospect.

S. Johnson staked six claims to cover the gold showings and optioned the property to Sherritt Gordon Mines Limited. A grid with a north-trending baseline and 400-foot line spacing was cut over the property. Magnetometer, horizontal loop electromagnetic, and geological surveys were completed in 1981. In 1982, trenching and sampling of the veins was conducted with encouraging results (Scime

1981). Since 1982, no work has been recorded for claims covering the showings. S. Johnson's claims lapsed in 1985.

All three quartz veins were covered by unpatented mining claims at the time of the property visit. The two more northern quartz veins (showings B and C) were on claims belonging to Arthur Mousseau of Savant Lake. The southern quartz vein (showing A) was on claims held by Norman Lee of Sioux Lookout. Only the quartz veins on A. Mousseau's claims were examined.

The two gold showings occur, for the most part, in coarse-grained mafic metavolcanic flows. Trowell (1983) mapped an east-trending sequence of mafic metavolcanics interlayered with felsic metavolcanics and gabbroic sheets in the area north of East Bay. The foliation trends north-northeast to northeast.

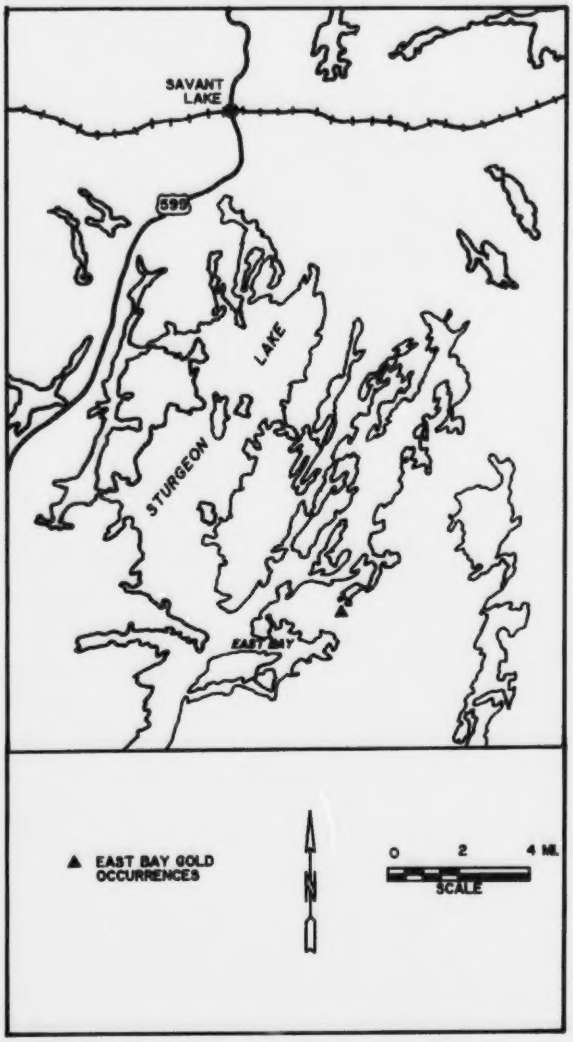


Figure 4.11. *Location map for the East Bay gold occurrences.*

Sherritt Gordon Mines Limited, for the most part, confirmed Trowell's mapping, but changed the thickness of the felsic units and interpreted the gabbroic rocks as coarse-grained mafic metavolcanic flows.

The junior author mapped the geology of claim number Pa. 844475, using Sherritt Gordon Mines Limited's grid for control. However, missing and unreadable pickets meant that outcrop shapes given on Sherritt Gordon Mines Limited's map were used for control instead of grid co-ordinates.

Mining claim Pa. 844475 is underlain by coarse-grained mafic metavolcanics with minor, finer grained mafic metavolcanics (*see* Figure 4.12). A unit of felsic lapilli-tuff outcrops in the southeastern quarter of the claim. The strike of the felsic lapilli-tuff unit is interpreted as paralleling the northeasterly trending foliation. Northwesterly trending faults offset the contact between the felsic metavolcanics and mafic metavolcanics.

In the northeastern corner of the claim, Sherritt Gordon Mines Limited mapped a second felsic unit. The junior author interprets this unit as a quartz porphyry dike. It differs from the quartz porphyritic lapilli-tuffs in that it lacks fragments. The quartz porphyry dike contains disseminated pyrrhotite and traces of chalcopyrite. The dike cannot be traced beyond the outcrop.

The gold showings were named the "B" showing and the "C" showing by Sherritt Gordon Mines Limited and for reasons of consistency, their use is continued in this report. Both veins have widths in the order of 0.5 m to 1.25 m and trend northeast. The dip of the quartz veins is generally steep to the southeast, but on the vertical trench wall, the dip of the veins is quite variable. The veins are composed of white quartz with traces of pyrite and chalcopyrite. Iron carbonate stringers are common in both veins. The wall rocks to the veins have been variably silicified for up to 1.5 m from the vein and mineralized with 1 to 2 percent disseminated euhedral pyrite. The wall rocks are not noticeably sheared.

The "B" showing received more detailed sampling by Sherritt Gordon Mines Limited than the "C" showing. The "B" showing quartz vein outcrops on the baseline at approximately 17+00 North. Here it is 15 to 30 cm wide, and it has not been well trenched or sampled. The vein is exposed to the northeast in a series of trenches for approximately 100 m. The vein terminates on the side of a northwest-trending valley, which is interpreted as a fault-related feature. The vein is a single entity for most of its length, but at the northeastern end, it is intersheared with mafic volcanic rocks for an aggregate width of 1.25 m. Channel sampling on the vein by Sherritt Gordon Mines Limited (Scime 1981) has yielded values up to 1.2 ounces gold per ton over 67.5 cm. However, the average grade is approxi-

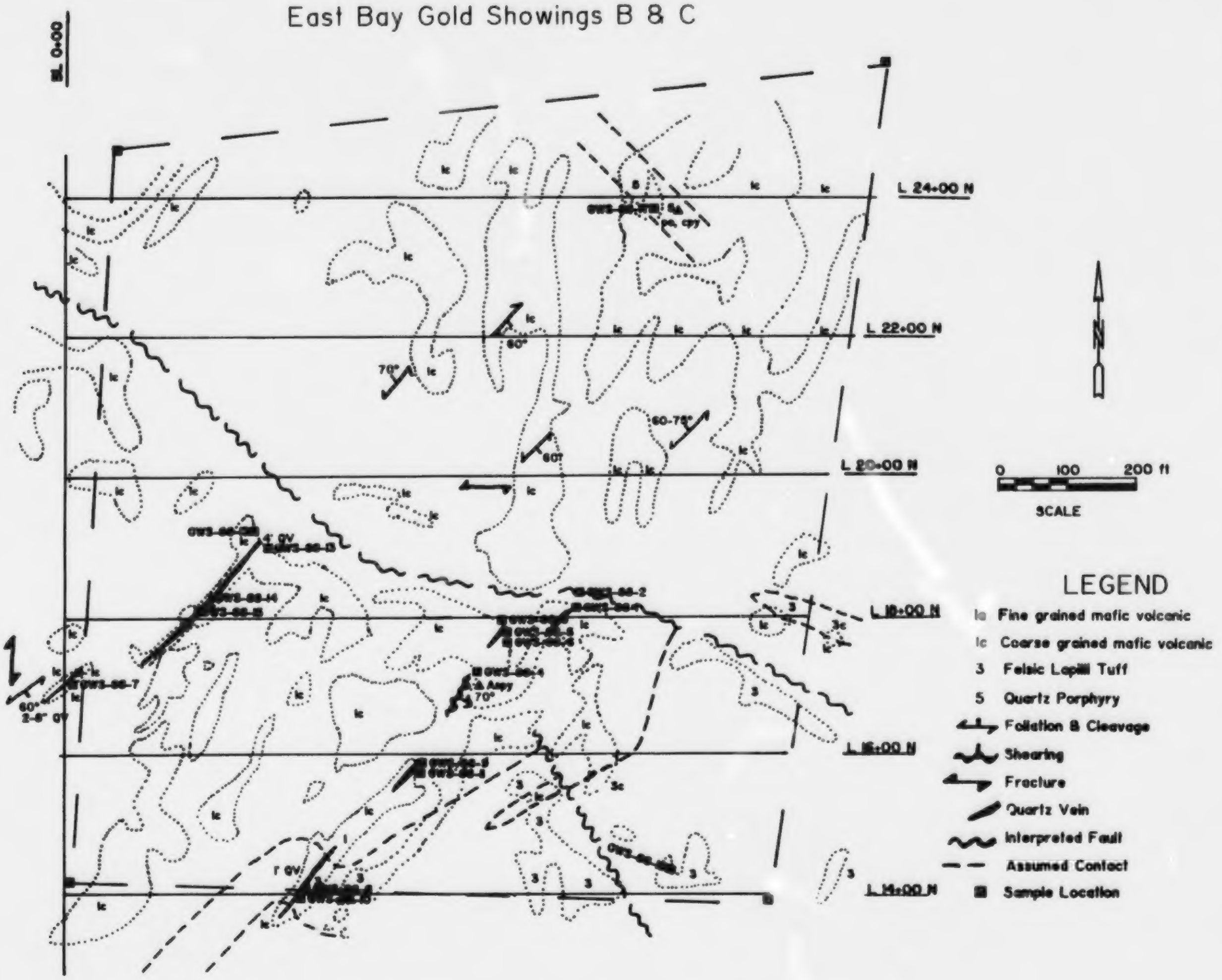

East Bay Gold Showings B & C
BL 0+00
L 24+00 N
L 22+00 N
L 20+00 N
L 18+00 N
L 16+00 N
L 14+00 N
N
0 100 200 ft
SCALE
LEGEND
lo Fine grained mafic volcanic
lc Coarse grained mafic volcanic
3 Felsic Lapilli Tuff
5 Quartz Porphyry
Foliation & Cleavage
Shearing
Fracture
Quartz Vein
Interpreted Fault
Assumed Contact
Sample Location

Figure 4.12. *Geological map of Mining Claim No. Pa. 844475.*

mately 0.23 ounce gold per ton over 50 to 70 cm. Values lower than this were received for some of the channel samples and several grab samples. The junior author took four grab samples along the length of the vein. The assay results (Geoscience Laboratories, Ontario Geological Survey, Toronto) are two values of 0.01 ounce gold per ton, and values of 0.18 ounce gold per ton and 0.19 ounce gold per ton.

The "C" showing is exposed in a series of outcrops from approximately 3+50E on L14+00N northeast to 6+30E on L18+00N. It terminates against the same valley as the "B" showing. The vein is not exposed continuously along its length and may be several lenses. Two interesting features of this vein and structure are a sheared, carbonatized, and silicified schist at approximately 17+00N 6+00E that contains disseminated pyrite and arsenopyrite, and a section of the vein that passes through a felsic lapilli–tuff on L14+00N.

The arsenopyrite–bearing schist is sheared parallel to the strike of the vein and the weak "regional" foliation and fracture cleavage. No quartz vein was found near this location.

The section of the vein that passes through the felsic lapilli–tuff is interesting in that instead of being a single 30 cm wide quartz vein as exposed in the mafic volcanic rocks, the vein is a quartz breccia with angular fragments of felsic volcanic rocks suspended in a matrix of white quartz.

The highest assay value returned from "C" showing grab samples was 0.0966 ounce gold per ton (Scime 1981). Grab samples taken by the junior author from all exposures of the vein, and from the outcropping arsenopyrite-bearing schist, assayed 0.01 ounce gold per ton or less.

Mechanical and hydraulic stripping to provide continuous exposure along the length of the veins and adjacent wall rock should be the first phase of any further work on the veins. Detailed mapping of the exposures, with particular attention paid to structure and alteration, should follow. Channel samples and small, bulk samples should be taken to determine the average grade of the quartz veins.

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5. Thunder Bay Resident Geologist's District—1988

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INTRODUCTION

Exploration activity in the Thunder Bay District in 1988 has almost doubled in comparison to 1987. Gold continues to be the most sought after metal; however, the rise in base-metal prices has prompted Inco Limited to commit itself to reopening the Shebandowan Mine in January 1989.

MINING ACTIVITY

Other than small-scale mining of amethyst (*see* Kennedy and Sherlock, this volume), this district has not had mineral production in 1988. Mineral production will resume in 1989 with the reopening of Shebandowan Mine. Annual production is expected to be 20 million pounds of nickel-copper concentrates. Mill capacity is 2500 tons per day. Current reserves are estimated to be 3.3 million tons grading 2.2 percent nickel and 1 percent copper, and an undisclosed amount of platinum group metals and cobalt. The mine is expected to employ 130 workers.

ADVANCED EXPLORATION AND DEVELOPMENT

TANDEM-STORIMIN, SNODGRASS LAKE AREA

A joint venture between Tandem Resources Ltd. and Storimin Exploration Limited carried out an underground exploration program at their Snodgrass Lake project in Moss Township. The program was initiated in August 1987 and terminated in June 1988. By the end of February, they completed a 700 m (2300-foot) decline to the 106 m (350-foot) level and a 53 m (175-foot) crosscut at the 70 m (230-foot) level, which accessed the mineralized zone along which 180 m (600 feet) of drifting was completed. In 1988, a 18 300 m (60 000 feet), 62-hole surface diamond drilling program and a 1525 m (5000 feet), 32-hole underground diamond drilling program were completed. This was complemented by ground geophysical, geological, and geochemical surveys. Tandem Resources Ltd. report in their 1988 annual report that sampling the drift at 1.5 m (5-foot) intervals has indicated an average grade of 0.18 ounce gold per ton over a length of 140 m (455 feet) across a drift width of at least 1.8 m (6 feet).

MIMISKA EXPLORATION INC., FERN-ELIZABETH PROSPECT

At the Fern-Elizabeth Prospect in Freeborn Township, Mimiska Exploration Inc. carried out a 12 940 m (42,456 feet), 79-hole diamond drilling program; extracted twenty-one, 100-pound samples for metallurgical testing; and continued geological and geochemical (humus) surveys, prospecting, stripping, and channel sampling. They have defined 125 376 t grading 6.33 g/t (0.18 ounce per ton) gold in the possible and probable categories. Renewed diamond drilling was initiated in early December (Bill Yeomans, Mimiska Exploration Inc., personal communication, 1988).

MADELEINE MINES LTD., LAC DES ILES AREA

Madeleine Mines Ltd. continues exploration and site preparation at its Lac des Iles platinum group metals prospect. Stripping, trenching, sampling, and metallurgical tests, as well as 1525 m (5000 feet) of diamond drilling, were performed in 1988. Buildings intended to house the crushing circuit and a machine shop as well as living quarters were erected.

EXPLORATION ACTIVITY

Exploration activity in the Thunder Bay District continues to increase, largely due to interest and successes in the Shebandowan greenstone belt. As measured by the number of active properties, exploration activity has almost doubled in 1988 over that which took place in 1987. In 1988, 84 properties were explored by junior mining companies and prospectors, as compared to 43 in 1987. In 1988, 21 properties were explored by major mining companies, as compared to 15 in 1987. Indirect measurements of exploration activity, such as the number of active claims and assessment work filed, indicate increased activity in 1988 for the Thunder Bay Mining Division (*see* Table 5.1).

**Presently Staff Geologist, Beardmore-Geraldton Resident Geologist's Office.*

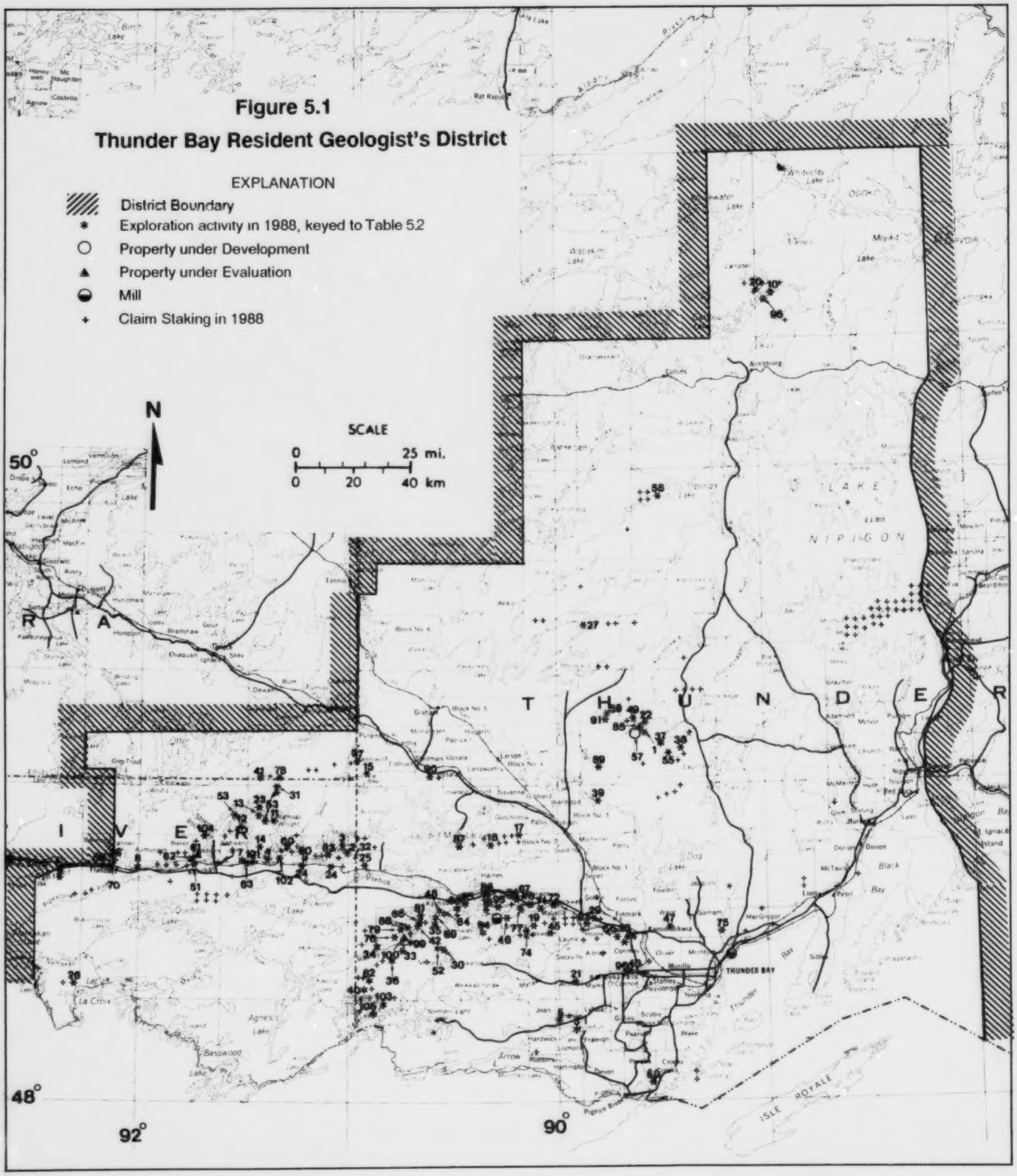

Figure 5.1
Thunder Bay Resident Geologist's District

EXPLANATION
▨ District Boundary
* Exploration activity in 1988, keyed to Table 5.2
○ Property under Development
▲ Property under Evaluation
◒ Mill
\+ Claim Staking in 1988
N
SCALE
0 25 mi.
0 20 40 km
50°
48°
92°
90°
R A
I V E R
T H U N D E R
L A K E
N I P I G O N
THUNDER BAY
ISLE ROYALE
Lake Nipigon
Black Bay
Thunder Bay
Armstrong
Collins
Upsala
Ignace
Atikokan
Kashabowie
Shebandowan
Whiteclay Lake
Ogoki Reservoir
Pigeon River

TABLE 5.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

THUNDER BAY MINING DIVISION

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1970	5,830	4,192	10,417	103,559	83,389	6,078	198,791
1971	4,627	5,211	9,833	63,774.25	53,028	7,456	131,962.72
1972	3,442	5,091	8,184	61,512.2	53,757.5	4,776	131,393
1973	2,253	5,515	4,922	49,575	24,320	7,450	94,308.6
1974	3,305	3,391	5,837	37,130.5	26,061	4,300	80,559.2
1975	3,436	2,869	6,404	38,652	52,020	4,700	105,338
1976	2,364	3,552	6,079	52,551.6	29,504	4,600	101,025.8
1977	1,964	2,966	5,077	24,879	25,601	4,870	68,727
1978	3,517	1,982	6,612	20,182	20,589	6,206	51,299
1979	3,099	2,139	7,554	11,528	69,612	14,727	101,799
1980	5,527	1,836	11,245	53,418	57,483	5,372	127,288
1981	6,768	4,162	13,851	55,256	172,366	13,863	256,686
1982	10,266	4,613	19,349	133,035	114,805	24,437	292,273
1983	15,835	1,537	33,547	113,554.3	439,992.8	64,789.1	664,891.3
1984	8,389	7,206	34,904	142,488.6	551,863.9	90,107.6	992,977.6
1985	4,353	10,222	29,035	170,022.8	475,736.7	65,802.1	794,099
1986	15,959	13,900	32,097	110,246.86	281,786.04	24,769.64	462,796.44
1987	16,269	7,712	41,568	205,369.2	724,924	54,631.9	1,070,214.4
1988	10,548	10,796	41,994	291,548.7	633,285.2	77,031.8	1,116,338.4

The increase in base-metal prices has resulted only in a slight increase in base-metal exploration. However, interest shown by the exploration industry at the year's end indicates that base-metal exploration will increase in 1989. The only substantial effect the rise in base-metal prices has had in the Thunder Bay District is the planned reopening of the Shebandowan nickel-copper mine.

Exploration for platinum group metals has decreased in 1988.

Exploration for gold was focused within the following areas: the Marmion Lake batholith; along the Quetico Fault; parts of Baker and Freeborn townships, northwest of Atikokan; and the entire Shebandowan greenstone belt.

The most active company in the district is Inco Gold Company. It was active on six properties within the Shebandowan belt. Its largest property covers most of Duckworth and Laurie townships and is referred to as the Gold Creek Property. Anomalous gold background values (up to 20 ppb) are common, especially within felsic pyroclastics and debris flows. More than 15 zones with anomalous gold values have been identified; six of these are associated with steeply plunging fold axes of synforms in which schistosity and mineral lineations are prominently developed in sericitized felsic volcanic rocks. Values as high as 3.45 ppm (0.1 ounce per ton) gold are reported from this environment (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). For example, a 12 m intersection from one diamond-drill hole from the E zone assayed 1.3 ppm (0.038 ounce per ton) gold. The mineralization consists of sericitized and silicified felsic lapilli tuff containing 2 to 4 percent pyrite as disseminations and fracture fillings.

The style of mineralization which is receiving the most attention on the Gold Creek Property is hosted by granodiorite dikes up to 10 m wide, as typified by the I zone. A large number of these dikes have been stripped, sampled, and drilled. Gold is found in quartz veinlets, which are oriented perpendicular to the strike of the dikes at less than 1 m spacings (i.e., ladder veins). Gold is also found at the contact between the dikes and the enclosing oxide facies banded iron formation. Visible gold and assays as high as 16 ppm (0.47 ounce per ton) gold have been reported from this environment (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

North Coast Industries Ltd. carried out a 1252 m, eight-hole diamond drilling program on their property near Shebandowan, in Hagey Township. Gold mineralization consists of disseminated and streaky pyrite in quartz-carbonate-sericite schist. As reported in the George Cross Newsletter on July 8, 1988, hole 88-7 cut 0.122 ounce gold per ton over 1.05 m; hole 88-8 had three intercepts: 0.132 ounce gold per ton over 1 m, 0.34 ounce gold per ton over 1.01 m, and 0.104 ounce gold per ton over 0.75 m. Hole 88-10 had one intersection grading 0.26 ounce gold per ton over 0.68 m, and hole 88-12 intersected 0.18 ounce gold per ton over 1.24 m.

TABLE 5.2. EXPLORATION ACTIVITY IN THE THUNDER BAY RESIDENT GEOLOGIST'S DISTRICT.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground Work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very Low Frequency

No.	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
1.	American Platinum Inc.	Lac des Iles (PGM)	Diamond drilling
2.	Andrews, M., Thew, R., Hicks, C.	Crooked Pine Lake (Au)	Stripping, trenching, diamond drilling
3.	Andrews, M., Thew, R., Hicks, C.	Crooked Pine Lake (Au)	Stripping, trenching
4.	Atiko Gold Mines Corporation Ltd.	McCaul Twp. (Au)	AEM
5.	Belore Mines Ltd. (Augusta Mine)	Strange Twp. (Ag)	Linecutting, geology
6.	Benderite, Adam	Conacher Twp.	Stripping
7.	Biralger Resources Ltd.	Schwenger Twp. (Au)	Prospecting, stripping
8.	Blue Regal Resources Ltd. (Law-Spence)	McOuat Lake (Au)	Linecutting, geology, Mag, VLF, IP, diamond drilling (610 m)
9.	Bolen, Jack (Seine East)	Wild Potato Lake (Au)	Linecutting, trenching, diamond drilling (264 m - 5)
10.	Burgess Point Resources Inc.	Linklater Lake (Au)	AEM, trenching, sampling, geology, VLF-EM
11.	Butte Resources Ltd.	Marmion Lake (Au)	AEM, geology
12.	Butte Resources Ltd. (Plator-Gralouise)	Marmion Lake (Au)	AEM, geology
13.	Butte Resources Ltd. (Stewart-Sande)	Marmion Lake (Au)	Linecutting, AEM, geology, Mag, diamond drilling (2367 m - 16)
14.	Butte Resources Ltd. (Jack Lake)	McCaul Twp. (Au)	AEM, geology, diamond drilling (1550 m - 10)
15.	Chapman, L.	Pyramid Lake (Au)	Diamond drilling (50 m - 1)
16.	Cominco Ltd.	Haines Twp. (Au)	Diamond drilling
17.	Cumberland Resources Ltd. (Dozy Lake)	Goodfellow Twp. (Cu,Zn,Au)	Linecutting, geology, soil and lithogeochem., diamond drilling (795 m - 6)
18.	Cumberland Resources Ltd.	Henderson Lake (Cu,Zn,Au)	AEM, linecutting, Mag, EM, geology
19.	Cummings, Walter and Associates	Duckworth Twp. (Au)	Linecutting, geology, Mag, VLF-EM

TABLE 5.2. CONTINUED.

No.	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
20.	Dorchester Resources Inc.	Linklater Lake (Au)	AEM, prospecting, geology
21.	Douglas, Arthur	Aldina Twp. (Cu,Mo,Au,Ag)	Stripping, trenching
22.	Equinox Resources Ltd. and Technigen Corporation	Lac des Iles (PGM)	Diamond drilling (610 m - 2)
23.	Falconbridge Limited (Hammond Reef)	Marmion Lake (Au)	Stripping, linecutting, geology, VLF, Mag, soil geochem., diamond drilling (3500 m - 18)
24.	Fleck Resources Ltd. and Bond Gold Canada Inc. (Kawene and Abiwin)	Crooked Pine Lake (PGM)	Diamond drilling (493 m)
25.	Fleck Resources Ltd. and Coventry Ventures Inc.	Bedivere Lake (PGM)	Diamond drilling (approx. 150 m - 3)
26.	Freewest Resources Inc.	Redhorse Lake (PGM,Cu)	Diamond drilling (920 m)
27.	Garden Lake Resources Limited	Garden Lake (Au)	Linecutting, IP
28.	Gitchee Gumee Gold	Hepburn Lake (Au)	Mag, VLF, linecutting
29.	Godzik, Alex	Dawson Road Lots (Au)	Stripping, trenching
30.	Golden Myra Resources Inc.	Burchell Lake (Au)	AEM
31.	Golden Winner Resources Ltd. (Golden Winner Mine)	Marmion Lake (Au)	Diamond drilling
32.	Grand Oakes Exploration Ltd. (Sawdo-Davidson)	Crooked Pine Lake (Au)	Linecutting, Mag, VLF, IP
33.	Grande Portage Resources Ltd.	Powell Lake (Au)	Stripping, diamond drilling (975 m - 8)
34.	Great Fortress Resources Inc. (South Moss)	Moss Twp. (Au)	Linecutting, Mag, VLF, geology, diamond drilling (1067 m)
35.	Grey Owl Resources Ltd. (Skimpole Lake)	Burchell Lake (Au)	Linecutting, mag., VLF-EM, geology
36.	Gunflint Resources Ltd.	Powell Lake (Au)	Stripping
37.	Heenan Senlac Resources Ltd.	Whitefin Lake (PGM)	Airborne geophys., geology
38.	Heenan Senlac Resources Ltd.	Max Lake (PGM)	Airborne geophys., geology
39.	Heenan Senlac Resources Ltd.	Wakinoo Lake (PGM)	Airborne geophys., humus geochem., channel sampling, diamond drilling (914 m - 12)
40.	Home Lake Resources Ltd. (Home Lake)	Powell Lake (Au)	Linecutting, geology, Mag, VLF, IP
41.	Homestake Mineral Development Co. (Red Paint Lake)	Norway Lake (Au)	Linecutting, soil and lithogeochem., stripping, trenching

TABLE 5.2. CONTINUED.

No.	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
42.	Inco Gold Company (Span Lake)	Burchell Lake (Au)	Prospecting, stripping, geology, diamond drilling (2590 m)
43.	Inco Gold Company (Calvert-Wing Opt.)	Conmee Twp. (Au)	IP, Mag, VLF-EM, diamond drilling (670 m)
44.	Inco Gold Company (Stewart Opt.)	Conmee Twp. (Au)	Prospecting, linecutting, geology, Mag, stripping, diamond drilling (790 m)
45.	Inco Gold Company (Gold Creek)	Duckworth and Laurie Twps. (Au)	Prospecting, linecutting, geology, Mag, stripping, diamond drilling (1860 m)
46.	Inco Gold Company (Shebandowan Property)	Hagey, Haines, and Conacher Twps. (Au)	Prospecting, linecutting, geology, Mag, stripping, diamond drilling (5330 m)
47.	Inco Gold Company	Ware Twp. (Au)	Stripping, geology, scintillometer survey
48.	International Corona Resources Ltd.(Lacana) (East Coldstream)	Burchell Lake (Au)	Mag, IP
49.	International Platinum Corp.	Lac des Iles (PGM)	Diamond drilling (1100 m - 5)
50.	International Platinum Corp. (Pine River)	Pardee Twp. (PGM)	Diamond drilling (1000 m)
51.	Interquest Resources Corporation	Freeborn Twp. (Au)	Prospecting, linecutting, Mag
52.	Jet Mining Exploration Inc.	Burchell Lake (Au)	AEM, stripping
53.	Kap Resources Ltd.	Marmion Lake (Au)	Airborne geophysics, prospecting
54.	Kroocmo, David	Factor Lake (Au,Ag,Cu)	Stripping, trenching
55.	Lundmark, Harry	Shelby Lake (Au)	Prospecting
56.	Lundmark, Harry, McAteer, Bill and Redden, James (Conmee North)	Conmee Twp. (Au)	Prospecting, trenching
57.	Madeleine Mines Ltd. (Roby Zone)	Lac des Iles (PGM)	Mill site constructions, stripping, trenching, bulk sampling, metallurgical, diamond drilling (1525 m)
58.	Madeleine Mines Ltd.	Puddy Lake (PGM,Cr)	Mag, HEM
59.	Madeleine Mines Ltd.	Tib Lake (PGM)	Mag, HEM, trenching, diamond drilling (760 m)
60.	McChristie, Wayne and Petrunka, David (Minto)	Hutchinson Twp. (Au)	AEM, stripping
61.	Exploration Mimiska Inc. (Fern-Elizabeth)	Freeborn Twp. (Au)	AEM, humus geochem., Mag, VLF, prospecting, stripping, channel sampling, bulk sampling, geology, diamond drilling (38 215 m)
62.	Exploration Mimiska Inc. (Harold Lake)	Freeborn Twp. and Miranda Lake (Au)	AEM, prospecting, diamond drilling (2446 m - 23)

TABLE 5.2. CONTINUED.

No.	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
63.	Exploration Mimiska Inc.	McCaul Twp. (Au)	Detailed geology
64.	Minerais Chabela Inc. (J.F. West)	Hagey Twp. (Au)	Geology, humus geochem., diamond drilling (2851 m - 22)
65.	Minnova Inc. and Wilco Mining Co. Ltd. (Vanguard)	Upper Shebandowan Lake (Cu,Zn,Au,Ag)	Stripping, geology, lithogeochem., IP, EM
66.	Newmont Exploration of Canada Limited	Burchell Lake (Au)	Geology, IP, Mag, VLF, diamond drilling (1850 m - 9)
67.	Newmont Exploration of Canada Limited (Shafton Lake)	Hagey and Conacher Twps. (Au)	Linecutting, geology, overburden drilling (450 m - 33)
68.	Newmont Exploration of Canada Limited	Kashabowie Lake (Au)	Geology, IP, Mag, diamond drilling (2744 m - 10)
69.	Noranda Exploration Company Limited (North Coldstream)	Burchell Lake (Au)	Geology, geophysics, diamond drilling (1157.5 m)
70.	Noranda Exploration Company Limited (Mayflower)	Hepburn Lake (Au)	Stripping, geology
71.	Noranda Exploration Company Limited (Bandore)	Conacher Twp. (Au)	Geology, geophysics
72.	Noranda Exploration Company Limited (Calvert-Wing Opt.)	Conacher Twp. (Au)	Geology, geophysics, geochem.
73.	Noranda Exploration Company Limited	Conmee Twp. (Au)	Geology, geochem.
74.	Noranda Exploration Company Limited (Penziwol Opt.)	Duckworth and Lamport Twps. (Au)	Stripping, geology
75.	Noranda Exploration Company Limited	Gorham Twp. (Au)	Geology, geochem.
76.	Noranda Exploration Company Limited (Ardeen)	Moss Twp. (Au)	Geology, geophysics
77.	North Coast Industries Ltd. and United Lincoln Resources Inc. (Hag Lake)	Conacher Twp. (Au)	Linecutting, geophysics, trenching, diamond drilling (1220 m)
78.	Premier Lake Resources Inc.	Norway Lake (Anderson) (Au,Ag,Cu,Zn)	Linecutting, Mag, VLF, geology, diamond drilling (1214 m)
79.	Rainbow Lake Resources Ltd. (Rainbow Lake)	Moss Twp. (Au)	Linecutting, Mag, VLF, geology, diamond drilling (1525 m)
80.	Rawlings, Glen and Bernatchez, Ray	Trottier Twp. (Au)	Stripping, trenching
81.	Rayrock Yellowknife Resources/Rea Gold Corporation	Burchell Lake (Au)	Trenching, prospecting, diamond drilling (2286 m - 14)
82.	Red Fox Resources Ltd. (Red Fox Lake)	Powell Lake (Au)	Linecutting, geology, Mag, VLF, IP
83.	Exploration Rogi Inc. (White Lily)	Trottier and Weaver Twps. (Au)	Linecutting, geology, Mag, VLF, stripping, diamond drilling (1812 m - 16)

TABLE 5.2. CONTINUED.

No.	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
84.	Sanders, Todd	Burchell Lake	Geology
85.	Sawdo, Robert	Lac des Iles (PGM)	Diamond drilling (450 m - 3)
86.	Schoor, Manfred	Haines Twp. (Au)	Stripping, trenching
87.	Schoor, Manfred	Henderson Lake (Au)	Linecutting
88.	Schoor, Manfred	Moss Twp. (Au)	Stripping, trenching
89.	Schoor, Manfred	Senga Lake (PGM)	Stripping, trenching
90.	Schoor, Manfred	Stedman Twp. (Au)	Stripping, trenching
91.	Schoor, Manfred	Tib Lake (PGM)	Trenching
92.	777607 Ontario Inc.	Dawson Road Lots (Au)	AEM, stripping
93.	S.M. Shebandowan	Upper Shebandowan Lake	Airborne geophysics
94.	Skalesky, Paul	Begin Twp. (Au)	Stripping
95.	Smith, Philip	Haines Twp. (Au,Ag,Mo)	Stripping, trenching
96.	Stewardson, Matt	Conmee Twp. (Au)	Stripping, trenching
97.	Stewardson, Matt and Angove, Richard	Pyramid Lake (Au)	Prospecting, sampling
98.	Sumtra Diversified (Fletcher Lake)	Linklater Lake (Au)	Trenching, linecutting, geology, Mag, HLEM, lithogeochem., diamond drilling (580 m - 6)
99.	Tamavack Resources Inc. and International Maple Leaf Resource Corporation (Fountain Lake)	Moss Twp. (Au)	IP, geology, diamond drilling (3500 m - 18)
100.	Tandem Resources Ltd. and Storimin Exploration Limited (Snodgrass Lake)	Moss Twp. (Au)	Underground dev., geology Mag, EM, humus geochem., diamond drilling (18300 m - 62, surface 1525 m - 32, underground)
101.	Ventex Energy Ltd. and Glen Auden Resources Limited (Olcott)	McCaul Twp. (Au)	Stripping, IP, diamond drilling (965 m - 9)
102.	Westbank Resources Inc. (Mammoth)	Hutchinson Twp. (Au)	Prospecting, linecutting, soil geochem.
103.	Whisper Lake Resources (Whisper Lake)	Saganagons Lake (Au)	Linecutting, Mag, VLF, geology
104.	Wicheruk, Mitch (Big Six)	Freeborn Twp. (Au)	Diamond drilling (125 m - 4)
105.	Wye Resources Inc. and Curran Bay Resource Ltd. (Powell Occ.)	Saganagons Lake (Au)	Stripping, trenching, linecutting, geology, diamond drilling (915 m - 13)

A joint venture, between Ventex Energy Ltd. and Glen Auden Resources Limited, is exploring the Olcott gold prospect in McCaul Township, east of Atikokan. A diamond drilling program in January produced several gold–bearing intersections. For example, hole No. 2 had one intersection of 3 m (9.9 feet) grading 0.106 ounce gold per ton; hole No. 6 had one intersection of 8.8 m (28.8 feet) grading 0.117 ounce gold per ton; and hole No. 7 had one intersection of 5.9 m (19.4 feet) grading 0.048 ounce gold per ton. Hole No. 2 was collared south of the known mineralization exposed at surface and oriented to intersect the down plunge extension. Holes No. 6 and 8 were collared southeast of the surface exposure and oriented parallel to the strike of the foliation, which in turn controls the quartz–carbonate veins which strike 60° to 90°. Schnieders and Dutka (1985) reported that the veins are tightly folded and, as such, have most likely undergone transposition parallel to the east–northeast–trending foliation. It is, therefore, difficult to evaluate the importance of the intersection in hole No. 6 as it may be parallel or perpendicular to the trend of mineralization. The mineralization in this hole consists of a bleached, sericitized zone with abundant quartz veins, up to 4 feet in width. This intersection contains 10 to 20 percent arsenopyrite and 5 to 10 percent pyrite (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

A joint venture between Fleck Resources Ltd. and Bond Gold Canada Inc. has been exploring a number of mafic intrusive rocks for PGMs within the Quetico sediments south of Crooked Pine Lake. Of these, only the Kawene intrusion, a 75 m by 500 m hornblende pyroxenite, contained significant platinum values. One ppm (0.03 ounce per ton) platinum was found in one, 1 m channel sample, and in one, 1 m diamond–drill intersection. A very thorough stripping and channel sampling program, followed by diamond drilling of significant surface values, was done (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist was staffed by G. Patterson, Resident Geologist; P. Sarvas, Staff Geologist; and J. Scott, Project Geologist. On July 8, G. Patterson resigned from his position, and on August 8, was replaced by M.J. Lavigne Jr. The Drill Core Library was staffed by G. White, Drill Core Library Geologist and P. Hinz, Assistant Drill Core Library Geologist. G. White resigned from his position on November 30.

Thirty–two property visits were carried out. Of these, several were in inactive areas which are considered to have potential for gold and base–metal mineralization. These are described in this section and summarized in the section entitled Recommendations for Exploration.

J. Scott has been carrying out geological mapping of Gorham Township.

PROPERTY EXAMINATIONS

ART DOUGLAS OCCURRENCE

The Art Douglas Occurrence is located in the northeastern corner of Aldina Township, approximately 50 km west of the city of Thunder Bay. The showing is near the west side of a dam across the outlet of the Serpent River at the northern end of Busby Lake. Prospectors Art Douglas and Francis Labrecque discovered the occurrence in 1987. To date, the two prospectors have exposed a 3 m by 6 m mineralized outcrop containing gold, copper, and molybdenum.

This occurrence is underlain by rocks of the Shebandowan greenstone belt, consisting of mafic to intermediate volcanic rocks and iron formations, intruded by granitic and gabbroic rocks (Tanton 1931). The property is north of, and in close proximity to, rocks of the Sunbar–Batwing Lakes granitoid complex. This intrusive complex is comprised of massive to foliated granite, granodiorite, monzonite, tonalite, and tonalite–granodiorite gneiss (Percival 1983). A contact–metamorphic aureole was imprinted on the greenstone rocks surrounding the granitoid complex, producing amphibolites.

The dominant regional planar structures (bedding, foliation, fold axial planes, and fault planes) trend west–northwest and dip steeply (Hanna Mines Limited, 1960, Resident Geologist's Assessment Files, Thunder Bay, Ontario). Hanna Mines Limited described a complex structural pattern with deformation of iron formation strongly influenced by the intrusion of mafic bodies. Geophysical maps also suggest a complex structural pattern (ODM–GSC 1961).

The Art Douglas Occurrence is hosted by fine–grained, dark green, massive to moderately foliated amphibolite (hornblende hornfels). Two types of amphibolite are present:

1. Fine–grained, massive to weakly foliated amphibolite comprised of hornblende, plagioclase, sericite, and chlorite.
2. Banded amphibolite consisting of thin (less than 1 cm alternating bands of dark green, fine–grained hornblende and buff–coloured, very fine grained feldspar–sericite–chlorite–hornblende. The mafic and felsic bands are highly deformed, in many cases folded and stretched into rods, boudins, and detached folds. Quartz, feldspar, and epidote veinlets cut the banded amphibolite.

Approximately 100 m east of the occurrence at the northeastern shore of Busby Lake, an outcrop of amphibolite has a very similar appearance to the am-

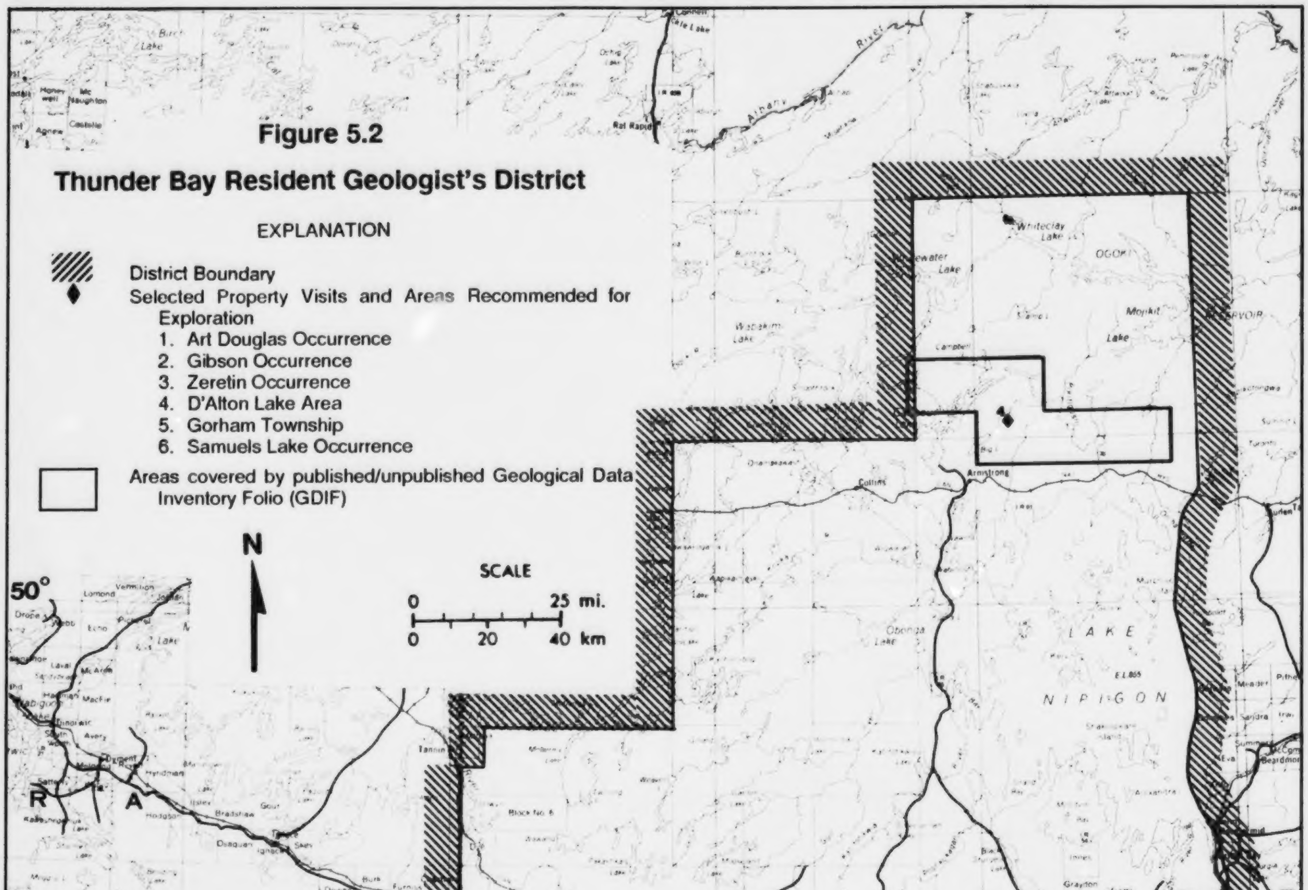

Figure 5.2

Thunder Bay Resident Geologist's District

EXPLANATION
▨ District Boundary
◆ Selected Property Visits and Areas Recommended for Exploration
1. Art Douglas Occurrence
2. Gibson Occurrence
3. Zeretin Occurrence
4. D'Alton Lake Area
5. Gorham Township
6. Samuels Lake Occurrence
☐ Areas covered by published/unpublished Geological Data Inventory Folio (GDIF)
N
SCALE
0
25 mi.
0
20
40 km
50°
48°
92°
90°
LAKE NIPIGON
THUNDER
RAINY RIVER
THUNDER BAY
ISLE ROYALE
Lac des Mille Lacs
Dog Lake
Black Bay
Armstrong
Nipigon
Whitecloy Lake
Ogoki

phibolites of the Art Douglas Occurrence. This amphibolite contains dark green, fine-grained selvages, suggesting the protolith to be pillowed mafic volcanic rock.

Mineralization, consisting of up to 5 percent chalcopyrite, molybdenite, and pyrite, is generally associated with the banded amphibolite. Fine-grained chalcopyrite, molybdenite, and pyrite are disseminated throughout the rock, but generally appear to be spatially associated with the felsic bands. Thin molybdenite bands are also found at the contacts between the veinlets and the amphibolite. Powellite ($CaMoO_4$) and scheelite are also present. The extent of the mineralization is open in all directions as the exposure consists of a 3 m by 6 m outcrop which is mineralized in its entirety. This occurrence has some characteristics of "porphyry-type" mineralization. An associated intrusion has yet to be identified.

Assays of eight grab samples from the Art Douglas Occurrence are as follows (Geoscience Laboratories, Ontario Geological Survey, Toronto):

Metal	Range	Average
Copper:	0.02% to 1.56%	0.65%
Molybdenum:	11 ppm to 3173 ppm	1860 ppm
Gold:	8 ppb to 2350 ppb	497 ppb
Silver:	nil to 21 ppm	6.75 ppm

GIBSON OCCURRENCE (TENT LAKE)

The Gibson Occurrence is located along a small, short creek between Tent Lake and another smaller lake to the southeast. It is approximately 2 km west-northwest of Miranda Lake, 25 km west of Atikokan, and 200 km west of Thunder Bay, in Asmussen Township. The occurrence was discovered by prospector Scott Gibson in 1988.

From a regional perspective, the Gibson Occurrence is located at or very near the contact of two major lithological assemblages: an elongate, north-trending lobe of tonalitic plutonic rocks centred around Miranda Lake and, west of this, a package of intercalated felsic and mafic metavolcanic rocks. In the vicinity of the Gibson Occurrence, the contact trends north-northwest and passes through the centre of Tent Lake (Fumerton 1986).

The Gibson Occurrence is poorly exposed within a ravine that trends 140°. The ravine is up to 5 m wide and 60 m long. The occurrence consists of a mafic body (dike or metavolcanic xenolith) surrounded by medium-grained, massive to weakly foliated tonalite. The mafic rock is dark green, fine grained, moderately to well foliated, and jointed. It is comprised mainly of biotite, chlorite, and plagioclase. The foliation and the contact between the mafic body and tonalite generally strike at 100° and dip steeply toward the south.

The mafic body is intruded by a stockwork of quartz veins. The veins are composed of white, vitreous to sugary quartz with up to 10 percent dark green chloritic seams and local, erratic sulphide mineralization (up to 2 percent fine-grained to medium-grained pyrite, chalcopyrite, and galena). Strong to moderate carbonatization, silicification, feldspathization, epidotization, and sulphidization occur at the vein-wall rock contacts. The veins are of variable width (up to 1 m) and orientation, but generally strike at 060° to 090° and dip steeply southward.

Grab samples of the quartz veins and wall rock returned assays ranging from nil to 120 ppb gold and nil to 1.32 ounces silver per ton. The highest silver assay (1.32 ounces silver per ton) came from a sample of highly carbonatized mafic host rock at a vein contact (Geoscience Laboratories, Ontario Geological Survey, Toronto).

ZERETIN OCCURRENCE

The Zeretin Occurrence is located on an elongate island in the southwestern part of Marmion Lake, 3 km north of the dam at Moose Lake and approximately 12 km north of Atikokan. The occurrence was rediscovered by Atikokan prospectors Gordon Martin and Robert Zerebsky in 1987, who found four, old, exploratory shafts. The shafts are found over a distance of 200 m at the top of a northeast-trending ridge.

A search of old claim maps and historical literature failed to reveal the ownership history or the mining venture responsible for the four exploratory shafts; however, development work probably occurred sometime in the 1890s. The years 1880 to 1900 represent the period of most extensive gold exploration in the Finlayson Lake-Marmion Lake area, culminating in production from the Harold Lake, Sawbill, and Hammond Reef mines, amongst others.

The property is underlain by trondhjemites and granodiorites of the Marmion Lake Batholith, and is east of, and in close proximity to, the northeast-trending Finlayson Lake greenstone belt (Fenwick 1976).

The Zeretin Occurrence is similar to other gold occurrences in the Marmion Lake Batholith (vein systems controlled by inhomogeneities in the Marmion Lake batholith, *see* Patterson *et al.* 1988). It consists of a quartz vein which strikes at 050° and 060° and dips steeply toward the southeast. The vein is of variable width, from a few centimetres to 1.5 m wide. It displays a crack-seal texture with white to smoky quartz and thin seams of chlorite. Locally, the vein is well mineralized (up to 20 percent sulphides) with pyrite, chalcopyrite, and galena.

The quartz vein is located at the contact between trondhjemite and a fine-grained mafic dike on the footwall. The trondhjemite is buff to grey, medium grained, and massive to well foliated. Generally, the batholithic rock becomes increasingly foliated nearer the quartz vein–mafic dike contact. The mafic dike is dark green on both weathered and fresh surfaces, fine grained, and massive to weakly foliated. The mafic intrusion is non–magnetic and appears to be composed mainly of amphibole and plagioclase. The width of the dike could only be determined at No. 2 pit where its maximum width is 3 m. At all other locations, the west–northwest contact of the dike is not exposed. At the southernmost pit, the mafic dike is not present and the vein is composite in character. It is possible that the dike is, in fact, a series of mafic intrusions along a persistent north–northeast–trending structural lineament.

Grab samples of quartz vein from the exploratory shafts returned values ranging from nil to 0.18 ounce gold per ton and from nil to 2.74 ounces silver per ton (Geoscience Laboratories, Ontario Geological Survey, Toronto). In addition, a sample of well–mineralized quartz vein from one of the shafts reportedly assayed 0.80 ounce gold per ton (Gordon Martin, Prospector, Atikokan, personal communications, 1988). Grab samples of the host trondhjemite and mafic dike returned nil gold assays.

Empirical data suggest gold is related to the presence of sulphides in quartz veins, especially chalcopyrite and galena.

D'ALTON LAKE AREA

D'Alton Lake is situated 25 km north–northeast of the town of Armstrong. The area is underlain by the northwest extension of the Onaman–Tashota greenstone belt of the Wabigoon Subprovince. D'Alton, Fuchsite, and Cumaway lakes are underlain by tholeiitic basalts with minor komatiitic flows, felsic intrusions, and iron formation (Sutcliffe 1987). The area is transected by an amphibolite–greenschist isograd and is cut by a set of northeast– and northwest–trending shear zones. Iron formation hosted by amphibolite grade deformed basalts provides an ideal situation for the generation of gold mineralization. For this reason, a reconnaissance survey of the area focused on sampling iron formation. Altered rock, mineralized shear zones, and quartz veins were also sampled.

All sites where iron formation was examined, with the exception of one on Fuchsite Lake, are located on D'Alton Lake. Sample sites and gold values are displayed on Figure 5.3. At sample sites 37 and 38, a lean iron formation containing a few magnetite–bearing beds has been sheared and contains secondary pyrite. A pyritic sample contains 40 ppb gold. Samples 39, 40, and 41 are pyritic. Samples 45 through 50 are from a highly altered, oxide facies, banded iron formation hosted by equally altered basalts. The alteration consists of ankerite which occurs as veins and pervasive replacement. Quartz veins are numerous and pyrite is common. An outcrop of sheared basalts to the immediate south has undergone both carbonate and potassic alteration, as indicated by the presence of calcite and biotite. Despite these encouraging indications of gold, six grab samples averaged 23 ppb gold. New Jersey Zinc Exploration Co. (Canada) Ltd. collared a 100 m diamond–drill hole to the east of the above sites and intersected carbonate and potassic alteration (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

Sutcliffe (1984, 1987) recognized the presence of a high density of faults in the area, the dominant orientation being 60° and to a lesser extent 160°. During the course of this examination, it was found that the most common orientation of schistosity is 50° to 60°. Several zones trending 80° to 90° and one at 30° were also found. The dominant shear zones dip to the southeast at 30° to 50°, with stretch lineations plunging to the northeast at 20° to 45°. Most of these shear zones have been hydrothermally altered. They contain quartz veins, iron carbonate as veins and pervasive replacement, and iron sulphides. For example, sample site 14 is an outcrop of basalt with patchy bleaching containing pyrite in a 1 m wide zone. A sample of this alteration contains 20 ppb gold. At sample sites 17, 18, and 19, a siliceous breccia at least 10 m wide was traced for 100 m, until it graded into a pyrite–impregnated shear zone which contained 22 ppb gold. Two samples of the siliceous breccia contain less than 2 ppb gold. At sample sites 35 and 36, a shear zone with disseminated pyrite generated 34 and 80 ppb gold from two samples.

The average gold content of samples collected from the D'Alton Lake area, excluding those from the Lett gold occurrence, is 17 ppb gold. The values in 34 samples range from 2 to 80 ppb gold (Geoscience Laboratories, Ontario Geological Survey, Toronto).

The most significant gold values found in this area came from the Lett Occurrence (*see* Sutcliffe 1987), a polymetallic vein which contains pyrite, chalcopyrite, sphalerite, and galena in variable amounts ranging from trace to 20 percent, with sphalerite being the most abundant. The highest gold value came from the sulphide poor, southwestern end of the vein (4330 ppb gold). The vein is exposed for 100 m and is up to 2 m wide. It trends 60° and dips 65° southeast. The vein is located at the contact between basalt (hanging wall) and quartz diorite (footwall). The quartz diorite has been sericitized and contains biotite segregations within 1 m of the vein. The basalts near the vein have been chloritized and contain anomalous amounts of biotite. This occurrence has been dormant since a diamond drilling program was completed in 1981 (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The area northwest of D'Alton Lake, including that near Cumaway, Fuchsite, and Michell lakes, has undergone deformation resulting in a high density of shear zones. Hydrothermal activity focused along these shear zones has produced anomalous gold concentrations; however, the only location with significant amounts of gold is at the contact between a felsic intrusion and basalt (Lett Occurrence). The ductility contrast generated by the juxtaposition of these two lithologies during deformation, generated the permeability necessary to allow sufficient passage of hydrothermal fluids to produce the gold–base metal–bearing vein. As most of the area is underlain by mechanically homogeneous basalt, it is recommended that prospecting be carried out in the vicinity of the numerous felsic intrusions northwest of Cumaway Lake, and in the area in between Michell and Caribou lakes. As interpreted from Sutcliffe's map of the area (1987), the geometry and the presence of foliation within these intrusions indicates their presence during deformation, and therefore, the capability of generating stress–induced permeability which allows fluid flow and the development of gold mineralization.

GORHAM TOWNSHIP

Gorham Township is located immediately north of the city of Thunder Bay. The southern third of Gorham Township has once again been the focus of gold exploration. Gold–bearing quartz veins were discovered by George Papineau at the Lakehead Gold Property in 1935, and by T. Christianson on what is now the Thunderhead Property, in 1945. Surface trenching and stripping at the time uncovered gold–bearing quartz over a strike length of 8 km, which is referred to as the Gorham Township Gold Trend.

The Lakehead Gold Mine Property, now owned by C. Poulin of Thunder Bay, was last explored by MacLeod–Cockshutt Gold Mines Limited in 1942. However, recent work on the property has been performed by the Canadian Nickel Company Limited in

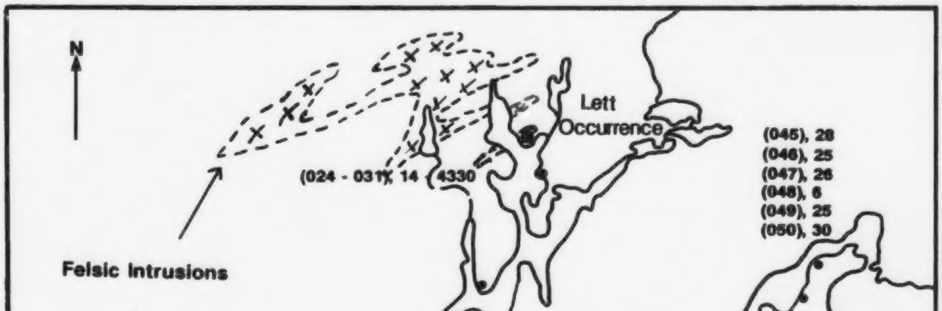

Figure 5.3. *Simplified geology of the D'Alton Lake area with numbered sample locations and gold values in ppb gold (●(037), 4). The area is underlain by mafic volcanic rocks (modified after Sutcliffe 1987).*

1986 and by Esso Minerals Canada in 1987. The following description is a summary from property reports supplied to C. Poulin by both (Canadian Nickel Company Limited and Esso Minerals Canada) companies.

In 1986, the Canadian Nickel Company Limited conducted geological, geophysical (IP and magnetometer), and geochemical (humus and soil sampling) surveys, followed by four diamond–drill holes. The four holes totaled 330.86 m and, in Canadian Nickel Company Limited's opinion, did not intersect any economic gold mineralization.

Esso Minerals Canada picked up the option from C. Poulin, plus an additional block from Mr. Aichinger. The company conducted a magnetometer survey on part of the option and geological surveys on the whole parcel. In addition, extensive power stripping exposed about 7000 m^2 of outcrop along the main vein systems. Channel samples were cut across the auriferous structures. The stripped outcrops were mapped at 1:100 scale.

Extensive channel sampling confirmed the presence of gold mineralization, although the mineralization, at least on surface, appears sporadic. There are indications that there are local areas of ore grade material of narrow widths and short strike lengths.

The geology is dominated by Archean pyroclastic lithologies in the occurrence area, and by Archean clastic and chemical metasedimentary rocks in the southern part of the property. The general strike of the lithologies is east, and facing directions, where discernible, indicate a southward younging sequence. The contact area between the metavolcanic and metasedimentary rocks, which has been interpreted by Esso Minerals Canada to be a structural contact, is marked by a predominance of chlorite schists.

The alteration assemblage associated with the quartz veining consists of iron carbonate, calcite, pyrite, sericite, and mariposite. Tourmaline and chlorite alteration is also evident in parts of the metavolcanic rocks. A zone of silicified and intensely iron–carbonatized metavolcanic rocks containing up to 5 percent pyrite were located in the northern sector of the area. This zone can be up to 3 m wide, and according to Canadian Nickel Company Limited is anomalous in gold. The zone can be traced across the property, but is best observed just south of the Gorham Gold Mines adit.

A significant assay result by Esso Minerals Canada was 0.42 ounce per ton gold obtained from a "rusty sericite–chlorite schist". No location is given in the report, but is thought to be located just west of the Gorham gold mine adit. This result is important because it may indicate the possibility of gold mineralization not associated with quartz veins and, therefore, tonnage and grades conducive to large-scale mining.

During the summer of 1988, a reconnaissance geological survey was conducted in that part of Gorham Township situated south of the trans–Canada Pipeline. Rock exposures along roads, hydro lines, gas pipelines, and bush trails were investigated and mapped. The stripped outcrops at the Lakehead Gold Mines Property were examined. The Thunderhead Gold Mine Property was visited and sampled, but not mapped.

While no major revisions to MacDonald's (1941) mapping are warranted, there appear to be some important differences. Mapping along the 230 kv hydro line between Hilldale Road and Onion Lake Road has indicated a significant package of altered and sheared mafic volcanic rocks, rocks that MacDonald (1941) has interpreted to be clastic metasedimentary rocks. While clastic and chemical metasedimentary rocks are present, they are not present to the extent indicated. Where they are present, these rocks are characterized by wackes and siliceous, magnetite iron formation. In some instances, this iron formation is banded with dark to red chert plus magnetite; in other areas, the iron formation consists of beds of magnetite within the wackes.

While the northern part of the metavolcanic belt through Gorham Township has very high mineral potential for gold (the Gorham Township Gold Trend), the southern part of the belt has good potential for base metals. A package of felsic metavolcanic rocks that trends from Kaministiquia easterly through Gorham Township to MacGregor Township has good indications of base–metal targets, especially in the vicinity of Mokomon (Mud) Lake, located in the eastern tip of Dawson Road Lots. Here, a sulphide–bearing zone within the felsic pyroclastic package contains 0.87 percent zinc, 0.24 percent copper, 0.12 ounce silver per ton, and 0.005 ounce gold per ton across 1 m. This zone crops out on Highway 102, north of Mokomon Lake.

In Gorham Township in the northern part of Concession I, Lot 13, sulphide mineralization is associated with sheared pyroclastic rocks. Analysis has indicated traces of base metals. Sulphide fragments occur within the pyroclastic rocks.

A curious dark grey to black chemical sediment has been located in two localities in the township. This sedimentary rock is finely laminated and is composed of almost 100 percent calcite. The unit is quite distinctive and could possibly serve as a marker horizon. The rock probably is an Archean limestone. The first locality is in a large trench situated just south of the 230 kv hydro line in the north sector of Lot 13, Concession I; the second occurrence is situated on Hilldale Road Extension, about 650 m south of the 230 kv hydro line. A chemical analysis of the rock done at the Geoscience Laboratories, Ontario Geological Survey, Toronto, yielded the following results: SiO_2: 8.37%; Al_2O_3: 1.70%; Fe_2O_3: 0.26%; FeO: 0.73%; MgO: 0.79%; CaO: 50.00%;

Na_2O: 0.02%; K_2O: 0.40%; TiO_2: 0.08%; P_2O_5: 0.02%; MnO: 1.78%(?); CO_2: 37.6%; S: 0.16%; H_2O^+: 0.27%; H_2O^-: 0.06%; LOI: 37.2%. More detailed work is required to determine this rock's origin and its significance, if any, in the regional geological picture.

The Gorham Township properties were sampled by this office many times (Patterson *et al.* 1984).

The reader is referred to the Thunder Bay Resident Geologist's files, MacDonald (1941), and Scott (in preparation) for more details.

SAMUELS LAKE PGM OCCURRENCE

A PGM occurrence within the Samuels Lake intrusive near the western boundary of the Thunder Bay District was investigated by M. Hailstone of the Kenora Resident Geologist's Office. A description of this occurrence can be found in Blackburn *et al.* (this volume).

DRILL CORE STORAGE PROGRAM

The Thunder Bay Drill Core Library is responsible for the collection and storage of diamond–drill core, and the monitoring of all drilling activities within the Thunder Bay Mining Division. The area of coverage is represented by three Resident Geologists' districts: Thunder Bay, Beardmore–Geraldton, and Schreiber–Hemlo districts. A total of 9756 m of diamond–drill core was collected and/or brought into the facility from 13 occurrences, prospects, and mines throughout the region during 1988 (*see* Table 5.3 for contributions). Approximately 87 810 m of drill core are presently stored, which represents about 75 percent of the library's designed capacity.

In addition to providing a reference collection, valuable assistance was given to the mining community by core library staff in terms of logging drill core from numerous properties, rock sample identification, location of drillhole collars in the field, and general technical information on diamond drilling. As the storage facility is approximately 75 percent full, great care is taken to select from available drill core, in the Thunder Bay Mining Division, that best

TABLE 5.3. THUNDER BAY DRILL CORE SUMMARY, 1988.

Property Name (by Resident Geologist's District)	Company	Location (Area, Twp.)	No. of DDHs	Metres Collected
THUNDER BAY				
1. Saganaga Lake	Curran Bay Res.	Saganaga Lake	8	140
2. Burchell Lake	Discovery West	Burchell Lake	14	2230
3. Stewart Property	Noranda Expl.	Conmee Twp.	38	2500
4. Lac des Iles	Equinox Res.	Lac des Iles	2	594
5. Shebandowan Mine	Inco Ltd.	Haines Twp.	2	266
6. Pyramid/Firesteel	L. Chapman	Hanniwell Twp.	1	50
				5780
SCHREIBER-HEMLO				
1. David Bell Mine	Teck-Corona	Bomby Twp.	2	23
2. Rabbit Oil & Gas	Omenica Res.	Wabikoba	3	320
				343
BEARDMORE-GERALDTON				
1. Maylac Property	Royal Oak Res.	Fulford Twp.	11	1822
2. Elmhirst Property	Elmhirst Syndicate	Elmhirst Twp.	9	550
3. Pan Empire Joint Venture	Ateba Mines	Summers Twp.	2	283
4. Walters Property	Goldhurst Res.	Walters Twp.	8	788
5. Willport Property	Ovalbay Joint Venture	Summers Twp	3	190
				3633
TOTAL COLLECTED				9756

represents the stratigraphy and mineralization from a particular property. This provides users with a more valuable collection of drill core from across the region.

Several projects have been generated by the collection of drill core at the central facility in Thunder Bay. For example, our understanding of the geology of the Hemlo belt will be improved as the result of the acquisition of approximately 18 000 m of diamond–drill core obtained from work done by Gold Field's Canadian Mining Limited on seven properties in the Hemlo area. Much of the drilling was done in areas of heavy overburden cover 8 km west of, and on strike, with the Hemlo deposits. The objective is to complete a portion of the unmapped geology (due to overburden cover) on Muir's OGS Map 2452 (1978) in this area, by logging the diamond–drill core.

Diamond–drill core from base–metal properties in the Onaman–Tashota belt of the Beardmore–Geraldton District will be re–logged, sampled, and assayed for precious metals. This core was generated during the late 1970s and early 1980s, a period during which base–metal exploration activity was high, and much of the core was not sampled and assayed for gold.

Since the Thunder Bay Drill Core Library began operation in November 1985, increased use of the facility by prospectors, geologists, mining company personnel, and the university community has continued, with users numbering 570 in 1988 (representing roughly a 30 percent increase from 1987).

RECOMMENDATIONS FOR EXPLORATION

The following recommendations are a summary of areas investigated by the staff of this office for which exploration is recommended. Detailed accounts of these areas are given in the section entitled Resident Geologist's Staff Activities.

The area between D'Alton and Caribou lakes is considered to have potential for gold mineralization, especially if prospecting is focused near the mafic volcanic hosted felsic intrusions. At the time of writing, this area was largely unstaked.

The Gorham Township Gold Trend, a shear zone hosted quartz vein system 8 km in length, has seen limited testing for its gold potential and is untested along strike to the east and west.

Gorham Township also has the potential for hosting volcanogenic massive sulphides, as indicated by the presence of base metals associated with felsic volcanic rocks.

A style of mineralization not common to the Archean was discovered this year. The Art Douglas Occurrence appears to be a "porphyry–type", gold–bearing, copper–molybdenum mineralization occurrence which needs further work.

Two new gold occurrences were discovered by prospectors this year; the Zeretin Occurrence and the Gibson Occurrence. Both of these occurrences are worthy of further examination.

Prospector Bill Hayne, from Thunder Bay, has produced some spectacular assays from his property near the eastern border of MacGregor Township. Three samples assayed contained 29.6, 0.5, and 0.6 ounces per ton gold. The samples were collected from 1 to 3 cm wide arsenopyrite veins hosted by black siliceous Archean metasedimentary rock near the Proterozoic unconformity. Esso Minerals Canada produced anomalous humus and B–horizon gold and arsenic anomalies in this same area (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

G. Beakhouse: Regional sampling; geochemistry of the Wabigoon diapiric axis.

T. Cortez: Regional mapping of the Obonga Lake greenstone belt.

M. Carter: Regional mapping and study of the rocks in the Shebandowan greenstone belt.

RESEARCH BY OTHER AGENCIES

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

Grant 225–S.A. Kissin and D.L. Archibald: Genesis of Pegmatites in the Quetico Belt of Northwestern Ontario—Pegmatites and Associated Granitoids of the Pine Portage Area

Grant 286–J.M. Sweeny and A.D. Edgar: The Geochemistry, Origin and Economic Potential of Platinum Group Element Bearing Rocks of the Lac des Iles Complex, Northwestern Ontario

Grant 300–S.A. Kissin and T.C. McCuaig: The Genesis of Silver Deposits in the Thunder Bay Area

Current research related to Grant 300:

R. Sherlock: Fluid Inclusion and Stable Isotope Studies at the Shuniah, Thunder Bay, Porcupine and Keystone Mines (MSc)

S. Burgess: Geology and Mineralogy of the Silver Mountain Mine (BSc)

CANADA–ONTARIO MINERAL DEVELOPMENT AGREEMENTS

Geological Survey of Canada Contracts

D. Davies (Royal Ontario Museum): Geochronological Studies of Detrital Zircons from the Quetico Metasediments

P. Morton and S. Schaeffer (University of Minnesota–Duluth): Volcanology and Petrology of Fragmental Ultramafic Rocks at the Steep Rock Mine

G. Skippen and L. Diamond (Carleton University): Carbonate Alteration Associated with Gold Mineralization in the Rainy River District

Lakehead University Activities

G. Borradaile: Magnetic Fabrics Associated with Shear Zones in the Shebandowan Greenstone Belt; Petrofabrics in the Seine Conglomerates Mine Centre

P. Fralick: Depositional Environment and Diagenesis of the Gunflint Formation, Thunder Bay; Sedimentology of Timiskaming "Type" Sediments, Finmark–Shebandowan

S. Gaudino: Sedimentological Processes Operative in a Glacial Deltaic Environment, Thunder Bay

M.M. Kehlenbeck: Fault Bounded Basin Structures; Zones of Transtension and Transpression–Quetico Subprovince

J. McArthur: Fluid Inclusion and Stable Isotopes on Amethyst—Thunder Bay Amethyst Mine (BSc)

R. Spark: Boundary Investigations of the Quetico Subprovince

Others

B. Cambray (Michigan State University): Tectonics of the Sibley Group

D. Lee (Atomic Energy of Canada Limited): Hydrogeology of the Sibley Basin

SELECTED PUBLICATIONS RECEIVED

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1988: Fluid Inclusion and Stable Isotopic Studies on Amethyst, Thunder Bay Amethyst Mine, Thunder Bay District, Ontario; HBSc Thesis, 108p., Lakehead University.

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6. Beardmore–Geraldton Resident Geologist's District—1988

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INTRODUCTION

The Beardmore–Geraldton Resident Geologist's Office completed its second year of operation since the January 1, 1987 subdivision of the Thunder Bay Mining Division. The Beardmore–Geraldton District is outlined on Figure 6.1a, 6.1b and includes the communities of Beardmore, Jellicoe, Geraldton, Longlac, Nakina, Fort Hope, and Lansdowne House. The Beardmore–Geraldton Resident Geologist's staff experienced an active year monitoring and stimulating mineral exploration in the Beardmore–Geraldton area (Wabigoon Subprovince) and the Fort Hope–Miminiska Lake area (Uchi Subprovince).

On May 5, 1988, Ateba Mines Inc. officially opened the Pan–Empire Mill and ore sorter, Beardmore, Ontario. Pelham Gold "N" Grain Inc.–Cumo Resources Ltd. commenced a gold tailings recovery project on the Consolidated Louanna gold mine, northwest of Nakina, Ontario. Advanced exploration continued on four properties: a) Magnet Consolidated gold mine (Ateba Mines Inc.–Roxmark Mines Limited) (underground); b) Theresa gold mine (Duration Mines Ltd.–J.S. Redpath Mining Consultants Limited) (underground—suspended operations October 1988); c) Hardrock Extension Inc. (underground planned 1989); and d) Pan–(Northern) Empire Mine (Ateba Mines Inc.) (underground planned 1989).

Over one hundred exploration programs including company and prospector projects were undertaken in the Beardmore–Geraldton District during 1988.

Ontario Mineral Exploration Program (OMEP) assistance totalling $1 718 354 was awarded in 1988 for exploration programs totalling $6 876 300.

MINING ACTIVITY

Ateba Mines Inc. officially opened the Pan–Empire Mill in May 1988, and reported mill–production figures, from November 1987 to September 1988, of 1717.41 troy ounces gold. At the Ateba Pan–Empire Mill, a 200 ton per day mill, 31 187.90 tons of ore–sorted material and screen machine fines from two mine dumps were milled. The total is made up of 14 846 tons of Leitch gold mine feed at a head grade of 0.1 ounce gold per ton and 16 336.9 tons of Northern Empire (Pan–Empire) gold mine feed at a head grade of 0.072 ounce gold per ton. The sorting and milling of Leitch gold mine's feed continues (Steven Wilkinson, General Manager, Ateba Mines Inc., Toronto, personal communication, 1988).

Pelham Gold "N" Grain Inc.–Cumo Resources Ltd. initiated a small scale gold tailings recovery program on the Consolidated Louanna gold mine, located 40 km north of Nakina. A gravity circuit has been set up to initially test the gold content of the tailings. The Consolidated Louanna gold mine milled approximately 70 000 tons of gold ore grading 0.22 ounce gold per ton during 1983 to 1984 (G. MacDonald, Manager, Mining Corporation of Canada Limited, Nakina, personal communication, 1984).

ADVANCED EXPLORATION AND DEVELOPMENT

Ateba Mines Inc.–Roxmark Mines Limited continued with an underground exploration program on the former Magnet Consolidated gold mine, west of Geraldton. Inferred reserves stand at 944 000 tons grading 0.17 ounce gold per ton (Ateba Mines Inc. 1987). Mapping, sampling, and diamond drilling have been concentrated on the lowermost 17 level. Vernon Shein (Project Geologist, A.C.A. Howe International, Toronto, personal communication, 1988) described it as follows:

> "The geology of the 17th level consists of ESE trending, steeply southward–dipping epiclastic (greywacke) and chemical (iron oxide facies iron formation) metasedimentary rocks intruded by chloritic, carbonatized gabbroic intrusive rocks."

Gold mineralization is associated with greyish–white quartz veins and replacement sulphides including pyrite and arsenopyrite in banded oxide–facies iron formations and clastic metasedimentary rocks. Preliminary channel sampling returned values of 0.125 ounce gold per ton over 3.6 m (12 feet) (Steve Wilkinson, General Manager, Ateba Mines Inc., Toronto, personal communication, 1988).

Duration Mines Ltd.–J.S. Redpath Mining Consultants Limited own the Theresa gold mine located approximately 10 km south of Longlac and east of Long Lake. Extensive underground drilling has taken place during 1987 to 1988. Exploration was confined to vein– and shear–zone–hosted gold mineralization occurring within a granodiorite and quartz diorite intrusion in contact with mafic metavolcanics. Work on the property has been suspended.

Hardrock Extension Inc. continued multiphase surface exploration on Kenogamisis Peninsula, southeast of Geraldton. Hardrock Extension Inc. announced plans to drive a 900 m (3000 foot) long decline into the Porphyry zone, Bingo Vein, Visible gold zone, Point Vein, and Discovery zone.

> "The three best drill intersections to date have returned assays of 0.79, 0.75, and 0.29 ounce gold per ton over a width of 18.0, 5.0, and 30.0 feet" (Northern Ontario Business, November 1988, p.73).

A new discovery was made in late November when drill hole HH No.72 intersected 38.4 feet grading 0.16 ounce gold per ton on the new Stanley Occurrence (Mike Malouf, President, Hardrock Extension Inc., Geraldton, personal communication, 1988).

Ateba Mines Inc. continued with surface exploration, bulk sampling, and diamond drilling on the Contact and Power Veins of the Pan–(Northern) Empire Mine in Beardmore. Shaft dewatering and underground exploration are planned for early 1989.

Metalore Resources Limited has discovered a gold–mineralized zone on the Knox Lake (or Cherbourg) Prospect located west of the Brookbank Deposit in Irwin Township. The occurrence is termed the "Golden Highway" and has been traced for 1200 m (4000 feet) along strike and is up to 22.5 m (75 feet) wide. The Brookbank Deposit's development remains on hold and its current reserves are 1.3 million tons grading 0.3 ounce gold per ton (Metalore Resources Limited 1988).

EXPLORATION ACTIVITY

Levels of exploration activity in the Beardmore–Geraldton area (Wabigoon Subprovince) and Fort Hope–Miminiska Lake area (Uchi Subprovince) have remained high. It is estimated by the authors that greater than 95 percent of exploration dollars were expended for the search for gold. Less than five percent of exploration dollars went to base metal, platinum group element, and industrial minerals exploration. Exploration for base metals has been concentrated in the Marshall Lake and Onaman River areas. Some lithium exploration took place in the Georgia Lake area. Gold exploration is extremely widespread throughout the district. Claim–staking data and assessment–work credit information for the entire Thunder Bay Mining Division are given in Table 5.1 of Lavigne *et al.* (this volume). Company exploration programs are summarized in Table 6.2.

Two of the larger projects, as summarized in Table 6.2, are as follows:

1. Teck Exploration Limited–San Paulo Explorations Inc. continued with an extensive diamond–drill and reverse circulation drill program on the former Leitch gold mine property.
2. Tarzan Gold Inc. (Glen Auden Resources Limited) has acquired by staking approximately 1359 claims covering the western extension of the Beardmore–Geraldton belt into Lake Nipigon.

The Thunder Bay Drill Core Library Summary (1988), which includes drilling activity in the Beardmore–Geraldton District, is given in Table 5.3 of Lavigne *et al.* (this volume).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Staff of the Beardmore–Geraldton Resident Geologist's District includes John Mason, Resident Geologist; Gerry White, Staff Geologist (starting December 1, 1988); C. Michael Hine, Staff Geologist (January 1 to July 30, 1988); and Cyndee Mack, Secretary. Allan Speed (Staff Geologist) and Susan Gaudino (Resource Geologist) worked on the Historical Research Project, which is funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

The Beardmore–Geraldton Resident Geologist's staff provided consultation and information to prospectors, mining company geologists, and consultants active in mineral exploration. Property visits, field trips, prospector classes, geology talks, and seminars were also undertaken.

Field offices in Beardmore and Geraldton were established and staffed for the months of May to October on a weekly, part–time basis and intermittently on demand for the winter months. The Beardmore Municipal Office hosts the Beardmore Field Office and the Ministry of Northern Development and Mines Office in Geraldton serves as the Geraldton Field Office.

Four major field trips were given in the Beardmore–Geraldton area to industry and prospectors.

A geological investigation was conducted on mineral properties in the eastern Uchi Subprovince (Fort Hope–Miminiska Lake area) designed to initiate a compilation of gold occurrences, prospects, and deposits. An aerial photograph lineament study was initiated in the Beardmore–Geraldton area.

Prospecting courses were delivered in Geraldton and assisted in Manitouwadge.

Geology and exploration talks were given both at the Thunder Bay Geoscience Seminar and the Scotia Bank Regional Meeting. Displays were presented at the Toronto, Thunder Bay, and Red Lake geoscience seminars.

Geological exploration data was submitted for a number of land-planning issues including the suitability of certain lakes for cottage subdivisions (required by the Ministry of Natural Resources, Geraldton); bridge-engineering studies (required by the Ministry of Natural Resources, North-Central Region); and small hydro projects planned within the Beardmore area.

Staff attended the Prospectors and Developers Convention in Toronto, the Canadian Institute of Mining and Metallurgy's Annual General Meeting in Edmonton, and the Insight-Mining Tax Seminar in Toronto.

PROPERTY EXAMINATIONS

BEARDMORE-GERALDTON AREA

General Geology and Structure

The geology of the Beardmore-Geraldton area's portion of the Wabigoon Subprovince has been divided into two belts: a) the Beardmore-Geraldton belt, and b) the Onaman-Tashota metavolcanic belt. The belts are separated by the Paint Lake Fault, a major transcurrent fault.

The Beardmore-Geraldton belt is situated within an east-trending, isoclinally folded, metavolcanic-metasedimentary sequence. Lithologic units have been transposed into a series of alternating slices of metavolcanics and metasediments within a wrench fault or megashear zone. The Beardmore-Geraldton belt has been subdivided lithologically into a) the Southern metavolcanic sub-belt, and b) the Southern metasedimentary sub-belt.

The Onaman-Tashota metavolcanic belt is a felsic to mafic, calc-alkalic and tholeiitic metavolcanic sequence bounded to the south by the Paint Lake Fault.

A detailed description of the geology and gold mineralization of the Beardmore-Geraldton belt and Onaman-Tashota metavolcanic belt is provided in Mason and White (1986) and by Mason and White *in* Patterson *et al.* (1984, 1985).

East Leitch (Wilport) Prospect

The East Leitch (Wilport) Prospect is located 4.8 km northwest of Beardmore. The property consists of 20 leased claims (TB 94984 to TB 94993; TB 95150 to TB 95157; and TB 95190, TB 95191) held by Falconbridge Limited and under option to (Minerais) Anodor Inc.. The East Leitch (Wilport) Prospect is accessible by Highway 580 and the Camp 72 Road. C. Larouche, Ovaltex-Minerais Anodor Incorporated (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay), summarized past mining and exploration activity:

> "Exploration in the 1930's uncovered the eastern extension of the Sand River and Leitch gold bearing structure on the East Leitch property. The Sand River and Leitch Gold Mines recovered slightly more than one million tons of ore grading 0.88 ounce gold per ton from the western part of this structure. The zone measures 325 feet in length with an average width of 8.2 feet. Drilling to a depth of 175 feet indicates 41 000 tons grading 0.16 ounces per ton."

Falconbridge Limited, in the mid-1960s, undertook an exploration program that identified two new gold-bearing vein systems. Further work did not commence until late 1987 when (Minerais) Anodor Inc., through Ovaltex (1986) Inc., initiated a multiphase exploration program including linecutting, prospecting, magnetometer surveying, electromagnetic surveying, and diamond drilling.

The East Leitch Property is underlain by mafic metavolcanic rocks overlain by northeast-striking metasediments; cumulatively, a portion of the Southern metasedimentary belt. Mafic metavolcanic rocks are typically fine- to medium-grained, massive flows, tuffs, and lapilli tuffs. The northern unit of metasediments is a medium-grained wacke to arkose with minor banded magnetite-chert (jasper) iron formation. The southern unit of metasediments consists of fine- to medium-grained, chloritic wackes with minor conglomerate. A dioritic intrusion was drill intersected in the metavolcanics.

C. Larouche (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay) described the structure of the East Leitch (Wilport) Prospect:

> "The regional structure is controlled by broad regional folding and extensive north east striking faults. A pervasive moderate to strong foliation strikes northeast with steep northerly dips. A lineation commonly plunges moderately to the west in the plane of foliation. This fabric relates closely to the fold axis and axial planes of regional folding. Minor folding and crenulations are observed on the outcrop scale. Extensive fault systems strike northeast along the sedimentary-volcanic interface. Minor shear zones strike north and north east. Mineral assemblages suggest metamorphic conditions of the greenschist facies."

C. Larouche (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay) described two types of gold mineralization at the main zone:

> "1. In quartz-carbonate veins or veinlets usually without mineralization. Nevertheless locally they become slightly mineralized.
>
> 2. In quartz-chlorite-sericite laminated veins, stockwork or stringers with a "crack and seal" texture close to the contacts where occur most of the mineralization. The sulfide content is mainly associated with the sericite lamination in the

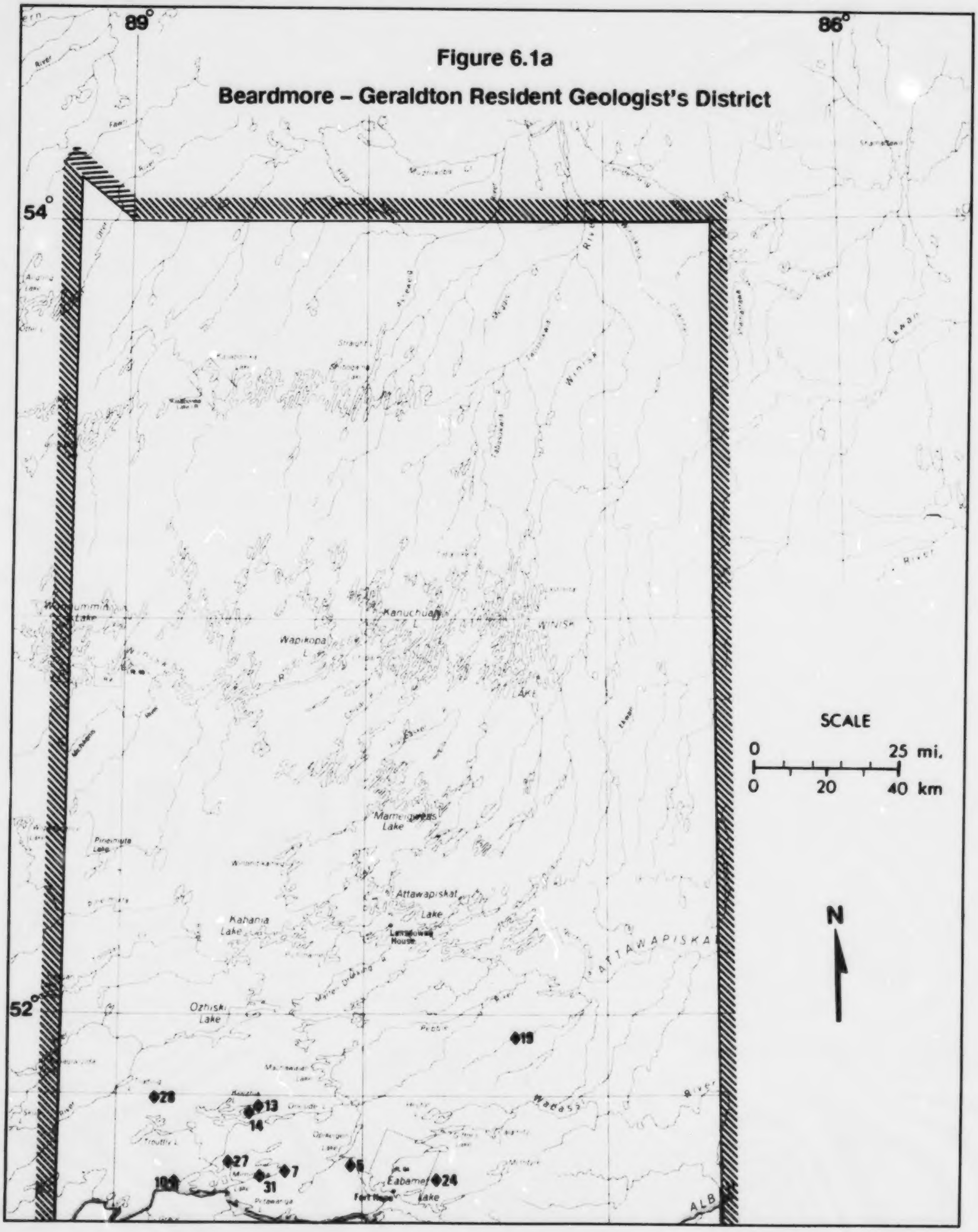

Figure 6.1a

Beardmore – Geraldton Resident Geologist's District

89°
86°
54°
52°
Winisk
Kanuchuan L
Wapikopa L
WINISK
Lake
Mameigwess Lake
Pineimuta Lake
Attawapiskat Lake
Kahania Lake
Lansdowne House
ATTAWAPISKAT
River
Ozhiski Lake
19
28
13
14
27
7
31
5
10
24
Eabamet Lake
Fort Hope
SCALE
0
25 mi.
0
20
40 km
N

EXPLANATION

◆ Property visits 1988

1. Consolidated Louanna Gold Mine
   (Cumo Resources Ltd.— Pelham Gold"N"Grain Inc.)
2. Expansion Lake Occurrence
   (Caviar Resources Ltd.)
3. F. Gagnon Occurrence
4. Foisey Occurrence
   (Freewest — Murgor Option)
5. Fort Hope Gold Mine (J. Reid)
6. G. Gilbert Property
7. Goss Lake Prospect
   (Tandem Resources Ltd. — Ayrex Resources Ltd.)
8. Hardrock Extension Inc. Prospects
9. Hardrock Gold Mine
   (Lac Minerals Ltd.)
10. Howells Lake Prospect
    (Baroque Resources Ltd. — Homestake Mineral Development Ltd.)
11. J. Koski
12. J. Savage Occurrence
13. KL–L–18 Occurrence
    (Noramco Mining Corp.)
14. KL–12 Occurrence
    (Noramco Mining Corp.)
15. Magnet Consolidated Mine
    (Ateba Mines Inc. — Roxmark Mines Ltd.)
16. Marshall Lake Cu–Zn–Ag Prospect
    (Granges Exploration Ltd.)
17. Missing Link Occurrence (N. Cox)
18. Northern Empire Mine
    (Ateba Mines Inc.)
19. Norton Lake Prospect
    (Duration Mines Ltd.)
20. OBK Occurrence (E. Rentz)
21. Pagwa Lake Occurrence (J. Shields)
22. Peddle Lake Occurrence
23. Randa Lake Occurrence
    (D. Downey — M. Pennock)
24. Reserve Creek Prospect
    (Goldpost Resources Inc.)
25. Sopko Occurrence
    (Discovery West Corp.)
26. Standingstone — Archie Lake Occurrence
    (J. Ternowesky — E. Rentz)
27. Szetu–Bayne Occurrence
    (Gold Fields Mining Corp.)
28. Talbot Lake Prospect
    (Placer Dome Inc.)
29. Theresa Gold Mine
    (J.S. Redpath Mining Consultants Ltd. — Duration Mines Ltd.)
30. Twin Falls Prospect
    (Atlantic Mining)
31. Wottam Lake Occurrence
    (Gold Fields Mining Corp.)

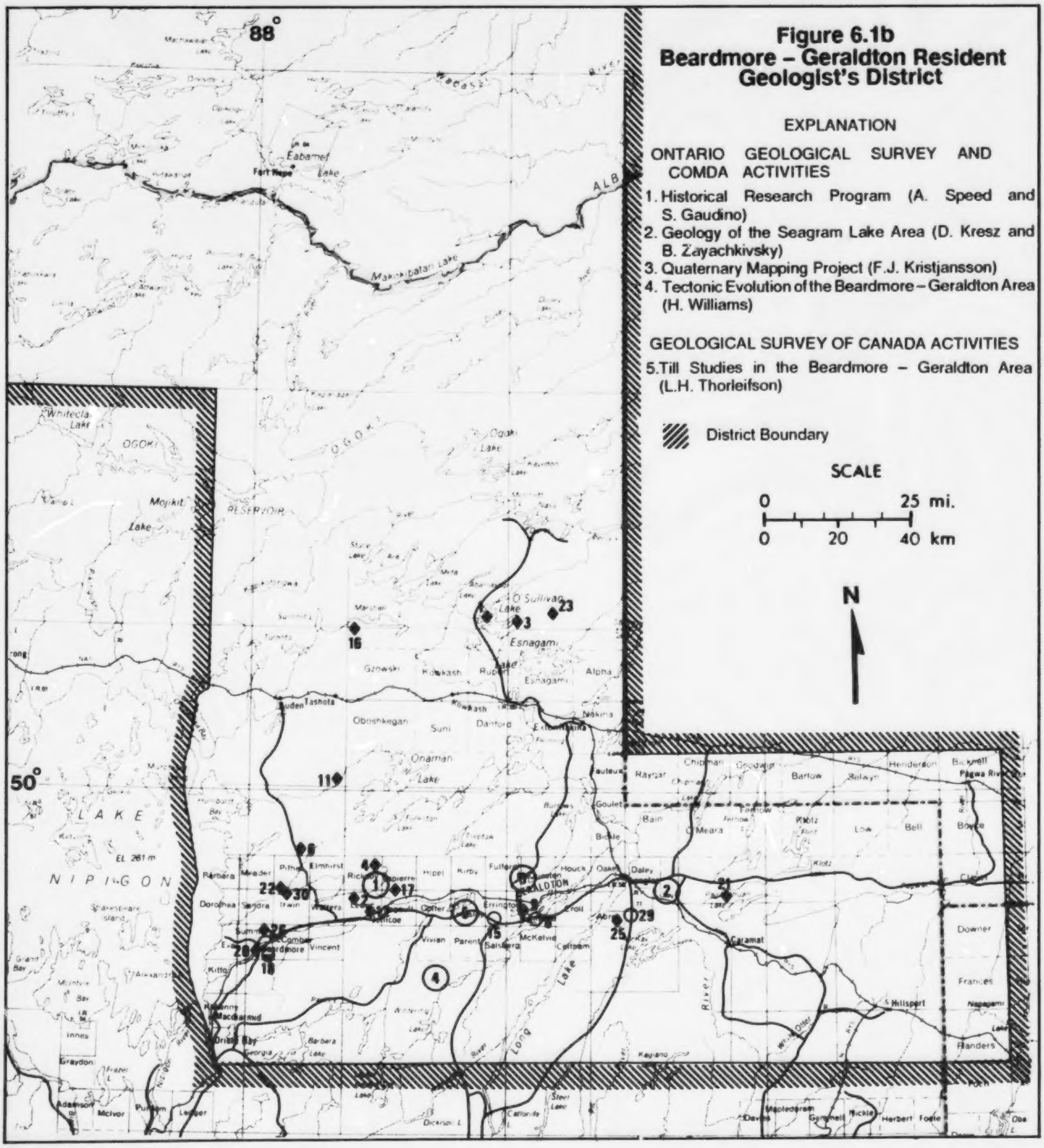

Figure 6.1b
Beardmore – Geraldton Resident Geologist's District

EXPLANATION

ONTARIO GEOLOGICAL SURVEY AND COMDA ACTIVITIES

1. Historical Research Program (A. Speed and S. Gaudino)
2. Geology of the Seagram Lake Area (D. Kresz and B. Zayachkivsky)
3. Quaternary Mapping Project (F.J. Kristjansson)
4. Tectonic Evolution of the Beardmore – Geraldton Area (H. Williams)

GEOLOGICAL SURVEY OF CANADA ACTIVITIES

5. Till Studies in the Beardmore – Geraldton Area (L.H. Thorleifson)

▨ District Boundary

SCALE
0
25 mi.
0
20
40 km
N
88°
50°
Eabamet Lake
Fort Hope
Makokibatan Lake
OGOKI RESERVOIR
Mojikit Lake
Whitecla Lake
O Sullivan Lake
Esnagami Lake
Onaman Lake
LAKE NIPIGON
EL 261 m
GERALDTON
Beardmore
Long Lake
Caramat
Hillsport
Nakina
Tashota
Obonhkegan
Suni
Danford
Grant
Kitto
Vincent
Vivian
Parent
Salsberg
McKelvie
Colfbam
Daley
Oakes
Houck
Fulford
Kirby
Hipel
Elmhurst
Pifher
Meader
Barbara
Dorothea
Sandra
Irwin
Errington
Croll
Bain
Goulet
Rayner
Chipman
Goodwin
Barlow
Selwyn
Henderson
Bicknell
Pagwa River
Boyce
Bell
Low
Downer
Frances
Flanders
Innes
Graydon
Adamson
McIvor
Pulham
Ledger
Davies
Herbert
Foote
Alpha
Ruper
Gzowski
Kowkash
Marshall
Alexander
Macdiarmid
Orient Bay
Georgia
Waterloo
Cottam
Calfonte
Maun
Mackasat
Kapikotongwa
Kaiyanowa
River
Ogoki
Albany
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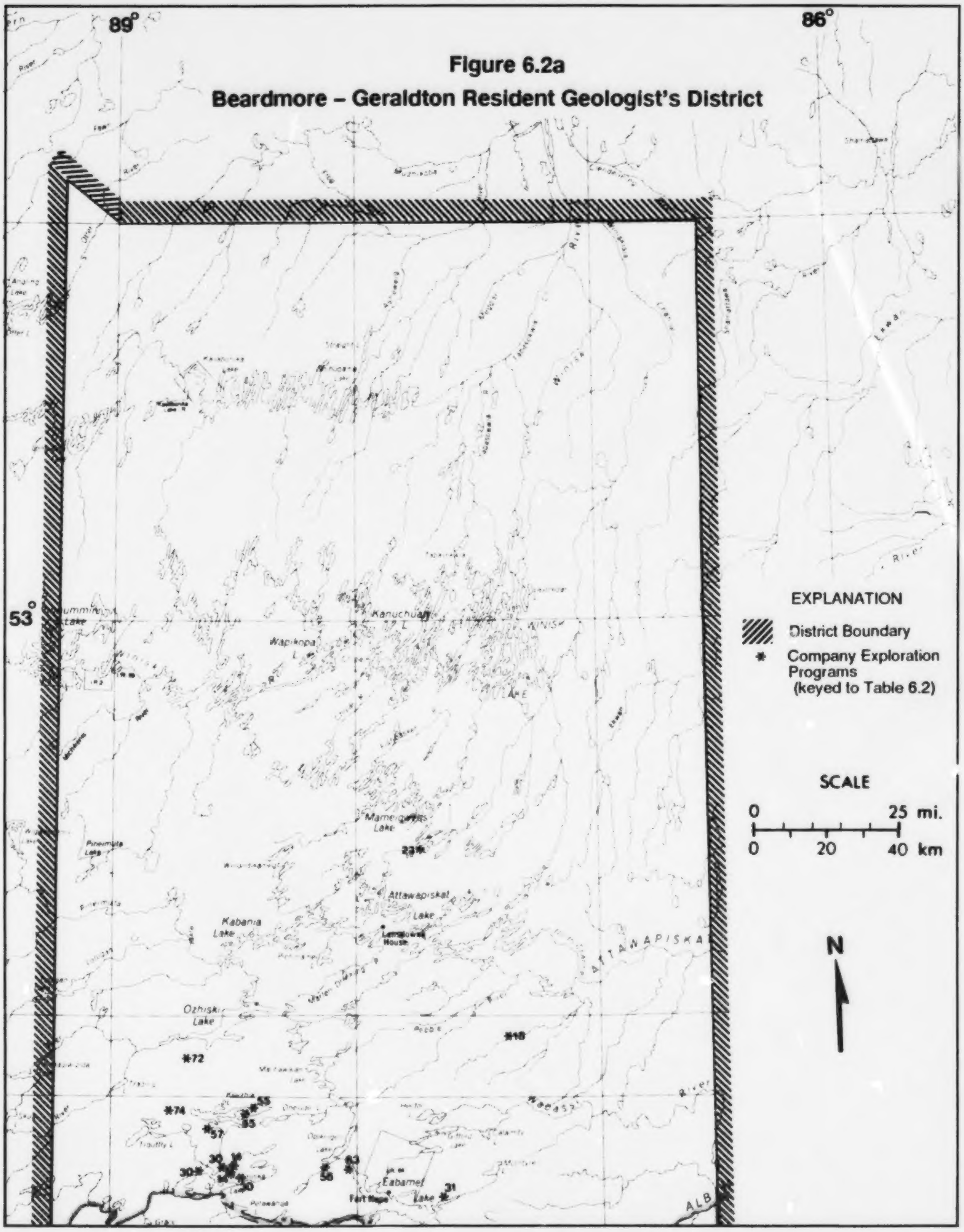

Figure 6.2a
Beardmore – Geraldton Resident Geologist's District

89°
86°
53°
Kanuchuan L
Wapikopa L
Mameigwess Lake
Pineimuta Lake
Attawapiskat Lake
Kabania Lake
Lansdowne House
ATTAWAPISKA
Ozhiski Lake
Eabamet Lake
Fort Hope
ALB
River
23
18
72
74
55
35
57
30
56
63
31
EXPLANATION
District Boundary
Company Exploration Programs (keyed to Table 6.2)
SCALE
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25 mi.
0
20
40 km
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Figure 6.2b
Beardmore – Geraldton Resident Geologist's District

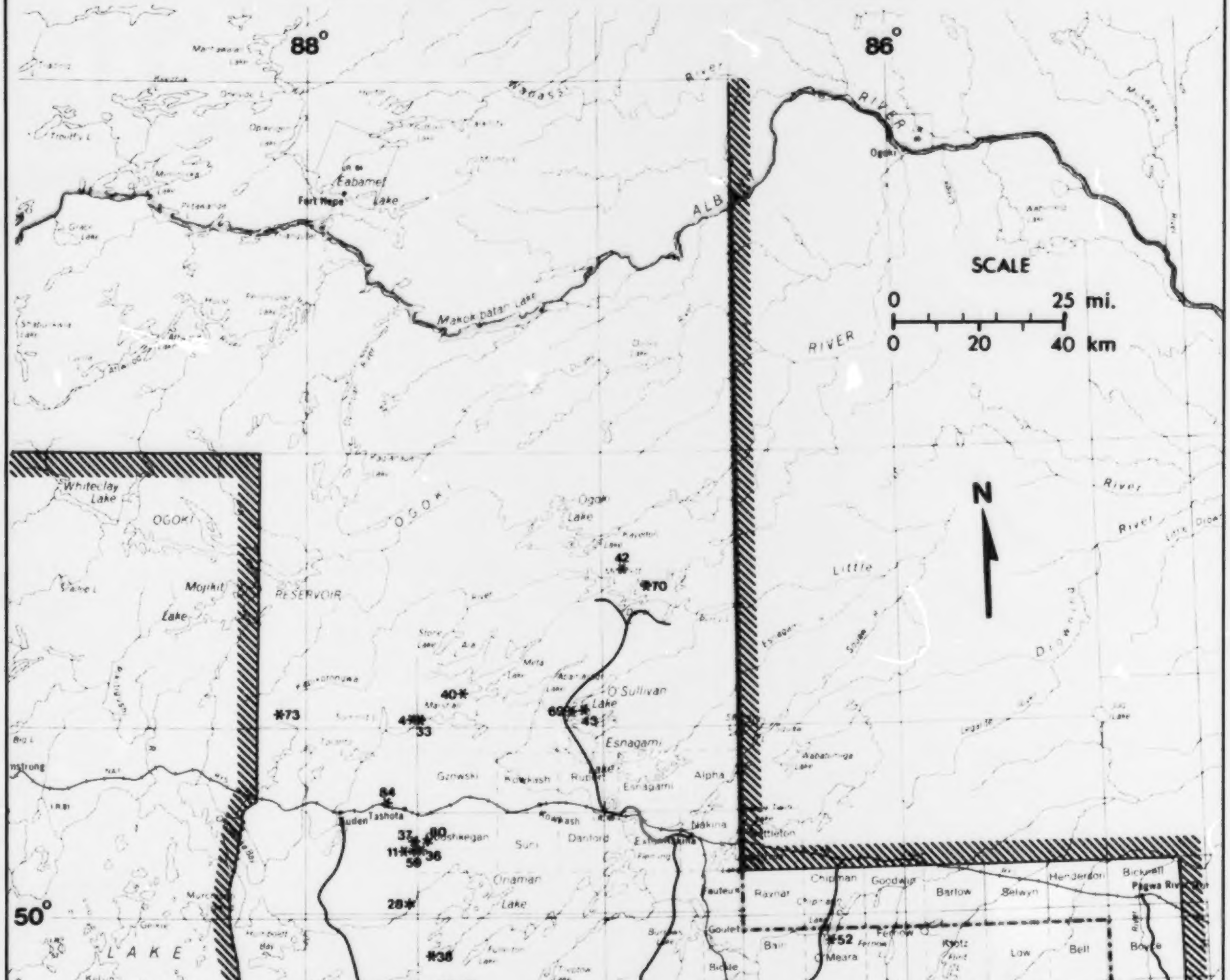
88°
86°
SCALE
0 25 mi.
0 20 40 km
N
50°
Eabamet Lake
Fort Hope
ALBANY RIVER
Makokibatan Lake
Ogoki
OGOKI RESERVOIR
Whiteclay Lake
Mojikit Lake
Ogoki Lake
O'Sullivan Lake
Esnagami Lake
Little Current River
Kenogami River
LAKE NIPIGON
EL 261 m
Shakespeare Island
Onaman Lake
Long Lake
Tashota
Auden
Nakina
GERALDTON
Beardmore
Caramat
Hillsport
Orient Bay
Macdiarmid
Barbara Lake
Humboldt Bay
Kowkash
Danford
Suni
Ozowski
Rutter
Esnagami
Alpha
Raynar
Chipman
Goodwin
Barlow
Selwyn
Henderdon
Bicknell
Pagwa River
Bain
O'Meara
Rowlandson
Low
Bell
Boyce
Houck
Oakes
Daley
Fulford
Kirby
Hipel
Vivian
Parent
Salsberg
McKelvie
Colbeam
Croll
Vincent
Dorothea
Leduc
Downer
Frances
Flanders
Innes
Graydon
Adamson
McIvor
Purdom
Ledger
Dickison L.
Davies
Mapledoram
Gemmell
Herbert
Foote
Kagiano
Kitto
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TABLE 6.1. COMPANY EXPLORATION PROGRAMS FOR THE PERIOD JANUARY 1, 1988 TO NOVEMBER 30, 1988. (keyed to Figure 6.2a, b)

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground Work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very Low Frequency

Company	Township/Area	Exploration
1) (Minerais) Anodor Inc.	Eva, Summers Townships	Geochemistry, DDH
2) Armeno Resources Inc.	Barbara Lake Area	Stripping
3) Armeno Resources Inc.	Lake Jean	Stripping, VLF-EM, Mag
4) Ataine Resources	Summit Lake Area	Geology
5) Ateba Mines Inc.	Summers Township	Geology, Geochemistry, DDH
6) Ateba Mines Inc.-Roxmark Mines Limited	Errington Township	UG DDH, Geochemistry
7) Blue Falcon Mines Limited	Lapierre Township	DDH
8) Blue Falcon Mines Limited	Legault Township	Geology, VLF-EM
9) Blue Falcon Mines Limited	Walters Township	EM
10) Bobex Resources Incorporated	Elmhirst Township	EM
11) Callisto Minerals Incorporated	Metcalfe Lake Area	Stripping, Trenching
12) Canadian Gold Resources Inc.	Leduc Township	Stripping, Trenching
13) Caviar Resources Limited	Leduc Township	Stripping, Linecutting, Geology
14) Cominco Ltd.	Miminiska Lake	DDH
15) Coulson Exploration Incorporated (Wescap Enterprises Limited)	Irwin, Walters, Dorothea Townships	Stripping
16) Discovery West Corp.	McBean Lake	Geochemistry, DDH, Stripping
17) Duration Mines Ltd.	McBean Lake, Laponen Lake Area	Linecutting, Trenching, Geology, DDH, UG DDH
18) Duration Mines Ltd.	Norton Lake Area	DDH
19) Elmhirst Syndicate	Elmhirst Township	DDH
20) Farboro Resources Inc.-Oz Explorations Inc.	Elmhirst Township	DDH
21) Ferau Resources Inc.	Long Lake Area	DDH
22) Flagship Resources Ltd.	McComber, Irwin Townships	Exploration
23) Forester Resources Inc.	Wapitotem Lake	Geology

TABLE 6.1. CONTINUED.

	Company	Township/Area	Exploration
24)	Freewest Resources Inc.-Murgor Resources Inc.	Rickaby Township	Linecutting, Stripping, Geology, Mag, VLF-EM, Geochemistry
25)	Geraldton Longlac Gold Inc.	Coltham Township	DDH, Stripping
26)	Getty Resources Limited	Klotz Lake, Pagwachuan Lake Area	DDH
27)	Glen Auden Resources Limited (Tarzan Gold Inc.)	Dorothea and Sandra Townships	Linecutting, Geology, Mag, IP, DDH
28)	Goldbrook Exploration Inc.	Coughlan Lake, Castlewood Lake Area	Stripping, Trenching, Linecutting, DDH
29)	Goldcrest Resources	Oakes Township	Geochemistry
30)	Gold Fields Canadian Mining Limited	Miminiska Lake, Ferguson Lake Area, Nesting Lake, Frond Lake	Geology, Biogeochemistry, DDH
31)	Goldpost Resources Incorporated	Reserve Creek Area	DDH, IP, VLF-EM, Mag
32)	Goldteck Mines Limited (Greater Temagami Mines Limited)	Elmhirst, Rickaby Townships	DDH, Geochemistry
33)	Granges Exploration Ltd.	Summit Lake Area	Linecutting, Geology, Stripping, VLF, Mag, Gradiometer, Geochemistry, DDH
34)	Gunnar Gold Inc.	Sandra Township	DDH
35)	Hardrock Extension Inc.	Ashmore Township	DDH
36)	Holmer Gold Mines Ltd.	Oboshkegan Township	Geology, Sampling, DDH
37)	Homestake Mineral Development Co.	Oboshkegan Township, Metcalfe Lake Area	Linecutting, Geology, Geophysics
38)	Hudson Bay Exploration and Development Co. Limited	Castlewood Lake Area	Stripping, VLF-EM, Geochemistry, DDH
39)	Hudson Bay Exploration and Development Co. Limited	Legault Township	Geochemistry, Mechanical
40)	Hudson Bay Gold Incorporated (Mingold Resources Inc.)	Meta Lake	Till geochemistry
41)	Jet Mining Exploration Inc.	Summers Township	Stripping, Geochemistry
42)	Kerr Addison Mines Limited	Ogoki Lake, Durer Lake Area	DDH, Geochemistry
43)	Kowkash Gold Corp.	O'Sullivan Lake Area	VLF-EM, Mag
44)	Lac Minerals Ltd.	Errington, Ashmore Townships	DDH

TABLE 6.1. CONTINUED.

	Company	Township/Area	Exploration
45)	Maki Exploration	Vincent Township	Trenching
46)	Metalore Resources Limited	Irwin, Walters Townships	AEM
47)	Mid North Engineering Services Limited	Colter Township	Geology, Geochemistry
48)	Mingold Resources Inc.	Colter Township	Geology, DDH
49)	Mingold Resources Inc.	Eva Township	VLF-EM, Mag, DDH
50)	Mingold Resources Inc.	Leduc Township, Clist Lake Area	Linecutting, Geology, Stripping, VLF-EM, Geochemistry, Mag, DDH
51)	Mingold Resources Inc.	Legault Township	Linecutting, Geology, Geochemistry, Geophysics
52)	Mingold Resources Inc.	O'Meara Township	VLF-EM
53)	Nelson Exploration	Leduc Township	Stripping, Trenching, Linecutting, Geophysics
54)	Nipigon Gold Resources Ltd.	Summers Township	AEM (VLF), A.M.
55)	Noramco Explorations Inc.	Keezhik Lake Area	Stripping
56)	Noramco Explorations Inc.	Opikeigen Lake, Rich Lake Area	Stripping
57)	Noramco Explorations Inc. (CBO Resources Corporation)	Nesting Lake	DDH. Geochemistry
58)	Noranda Exploration Company Limited	Lindsley, Errington Townships	DDH
59)	Noranda Exploration Company Limited	Oboshkegan Township	Geology, Prospecting, VLF-EM, H.E.M., Mag, Biogeochemistry
60)	Noranda Exploration Company Limited (Golden Trio Minerals Ltd.)	Vincent Township	Geology, Geochemistry, DDH
61)	Noranda Exploration Company Limited (Jamie Frontier Resources Inc.)	Sandra Township	DDH, Geochemistry, IP, EM, VLF-EM
62)	Northern Concentrators Limited	Pifher Township	EM, Mag
63)	Ohio Resources Corporation (Reid, R.J.)	Rich Lake Area	Mag, Geology, Soil Geochemistry
64)	Optrix Radiation Incorporated	Clist Lake Area	Geology, EM
65)	Optrix Radiation Incorporated	McComber Township	EM, Geology
66)	Orofino Resources Limited	Rickaby Township	Mag, DDH

TABLE 6.1. CONTINUED.

	Company	Township/Area	Exploration
67)	Panthco Resources Inc.	Hipel Township/ Lapierre Lake Area, Legault and Colter Townships	VLF-EM, Mag Stripping
68)	Panthco Resources Inc.	Sandra, Irwin, Summers Townships	VLF-EM
69)	Pelham Gold "N" Grain Inc.-Cumo Resources Ltd.	O'Sullivan Lake Area	DDH
70)	Placer Dome Inc.	Durer Lake Area	Linecutting
71)	Placer Dome Inc.	Irwin, Pifher, Elmhirst, Walters Townships	Geology, DDH
72)	Placer Dome Inc.	Keezhik Lake Area	HEM, Mag, DDH, Geology, Geochemistry
73)	Placer Dome Inc.	Lamaune Lake Area	Geology, DDH
74)	Placer Dome Inc.	Talbot Lake	DDH, Geochemistry, Geology
75)	Quillo Resources Inc.	Colter Township	DDH
76)	Rayrock Yellowknife Resources Inc.	McBean Lake Area	Stripping, Geology, Geochemistry
77)	Riverton Resources Corp.	Sandra Township	VLF-EM, Mag
78)	Ruza Resources	Errington, Lindsley Townships	Mag
79)	Seaway Base Metals Ltd.	Lapierre Lake Area	Geology
80)	Sherritt Gordon Mines Limited	Oboshkegan Township Area	Stripping, Geology, Geochemistry
81)	Stratmin Inc.	Summers Township	DDH
82)	Sweany Gold Corporation Parklane Technologies Inc.	Meader Township	DDH
83)	Sweany Gold Corporation-Parklane Technologies Inc.	Pifher Township	Geology, Geochemistry, DDH
84)	Tashogan Minerals-Halcyon Resources Ltd.	Tashota Lake Area	DDH
85)	Teck Exploration Limited-San Paulo Explorations Inc.	Eva, Summers Townships	DDH, RC Drilling

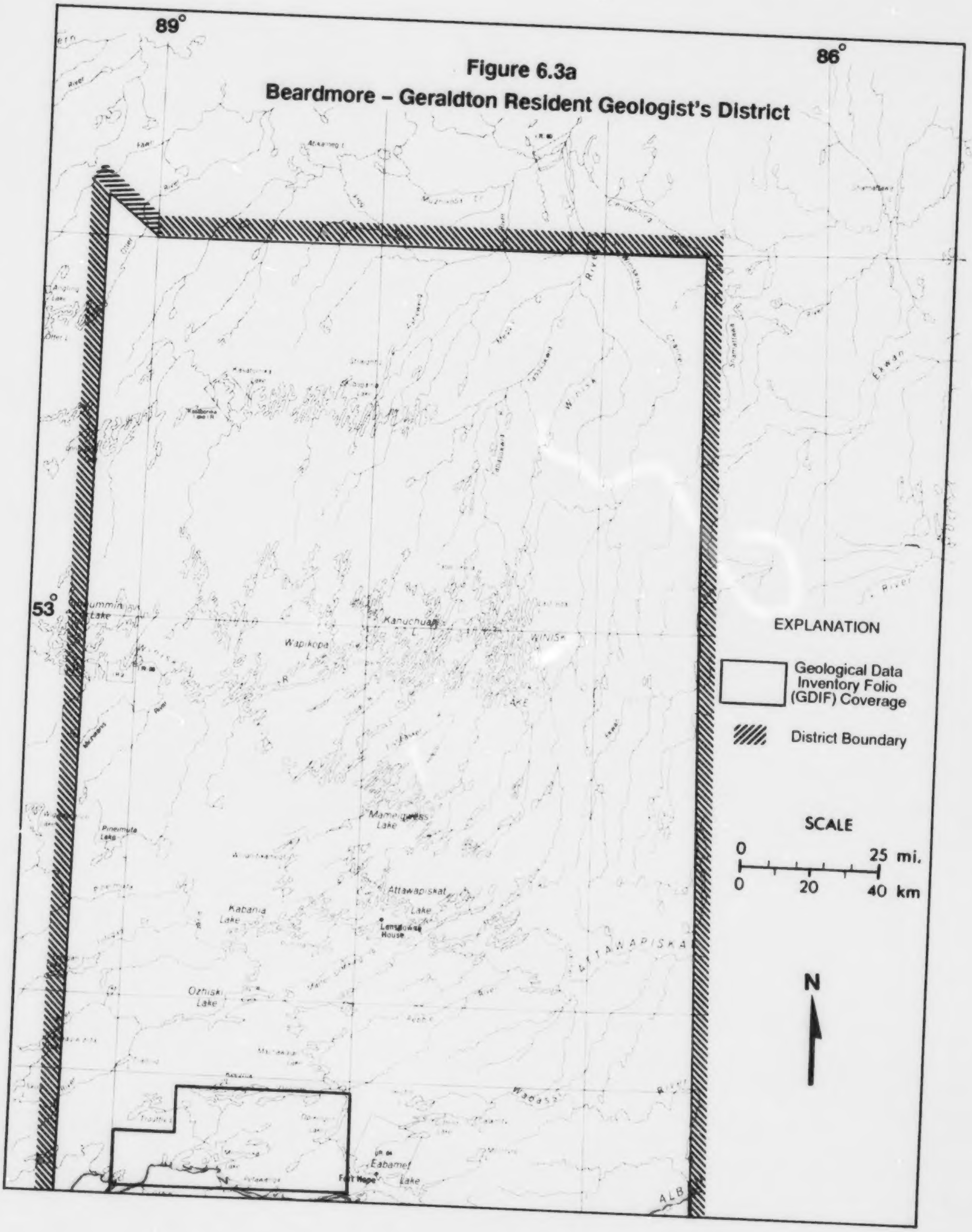
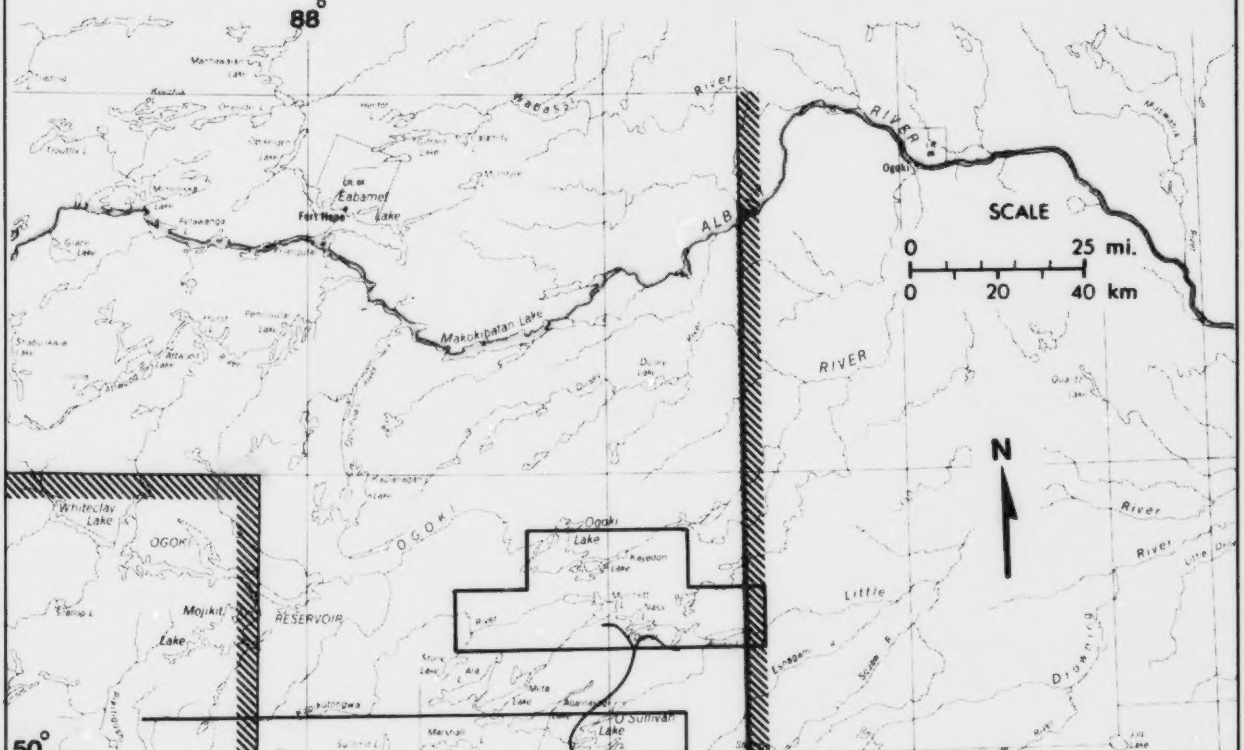


Figure 6.3a
Beardmore – Geraldton Resident Geologist's District

89°
86°
53°
EXPLANATION
Geological Data Inventory Folio (GDIF) Coverage
District Boundary
SCALE
0
25 mi.
0
20
40 km
N
Kanuchuan L.
Wapikopa L.
WINISK
Winisk
River
Mameigwess Lake
Attawapiskat Lake
Lansdowne House
Kabania Lake
Ozhiski Lake
Pineimuta Lake
Eabamet Lake
Fort Hope
ATTAWAPISKA
Wabassi
River
Ekwan
River
ALB

Figure 6.3b
Beardmore – Geraldton Resident Geologist's District


88°
50°
SCALE
0
25 mi.
0
20
40 km
N
Eabamet Lake
Fort Hope
Makokibatan Lake
ALB
RIVER
Ogoki
RIVER
River
River
Little
Drowning
Whiteclay Lake
OGOKI
Mojikit Lake
RESERVOIR
O G O K I
Ogoki Lake
O'Sullivan Lake
Esnagami Lake
Gzowski
Kowkash
Rupert
Esnagami
Alpha
Oboshkegan
Suni
Danford
Onaman Lake
Nakina
Raynar
Chipman
Goodwin
Barlow
Selwyn
Henderson
Bicknell
Bain
O'Meara
Low
Bell
Boyce
L A K E
N I P I G O N
EL 261 m
Barbara
Meader
Pifher
Elmhirst
Rickaby
Lapierre
Fulford
Houck
Oakes
GERALDTON
Dorothea
Sandra
Irwin
Walters
Leduc
Errington
Abrey
Summers
Eva
Beardmore
Vincent
Vivian
Parent
Salsberg
McKelvie
Caramat
Kitto
Long Lake
Hillsport
Downer
Frances
Flanders
Innes
Graydon
Adamson
McIvor
Purdom
Ledger
Kagiano
Daveis
Gemmell
Nickle
Herbert
Foote

quartz stringers zone. The sulfides are usually pyrite but sometimes arsenopyrite can be as important as the pyrite (up to 6% of sulfides locally)."

A number of significant drill intersections were received following 2700 m (9016 feet) of diamond drilling. Hole AEL-87-20 encountered 12.5 m (41.7 feet) of 0.53 ounce gold per ton (C. Larouche, Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay).

Gold mineralization is also associated with a sulphide zone in the drill-intersected diorite intrusion (claims TB 94985, TB 94986) and with arsenopyrite (3 percent) and pyrite (3 percent) in coarse-grained, strongly foliated tuffs hosting quartz-chlorite-sericite laminated stringers (C. Larouche, Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay).

Expansion Lake Occurrence

The Expansion Lake Occurrence is located in the northwestern portion of Leduc Township. The property is accessible via Highway 801 to the western end of Paint Lake, then by boat eastward for 10.4 km (6.5 miles), and finally by trail and canoe for a further 1.0 km (0.6 mile) of travel. The Expansion Lake Occurrence was staked by Gerry Bruce (Prospector, Jellicoe) and subsequently optioned to Caviar Resources Limited, Toronto. Eighty-one claims cover both the occurrence and the surrounding high mineral potential area. Trenching, stripping, geological surveys, geophysical surveys, and sampling have been conducted.

The Expansion Lake Property straddles the boundary between the Beardmore-Geraldton belt and Onaman-Tashota belt. The Paint Lake Fault strikes easterly through the property and marks the contact between the two belts. The northern portion of the property (Onaman-Tashota belt) is underlain by intermediate to felsic metavolcanics including tuff, "tuff breccia, pyroclastic breccia and derived schists" (Mackasey 1976). The central and southern portion of the property (Beardmore-Geraldton belt) is underlain by massive and pillowed mafic metavolcanics. In possible fault contact with the metavolcanics is a narrow, laterally extensive, east-trending sequence of polymictic conglomerate and minor sandstone. Late north-trending diabase dikes cut all rock types. Regional foliation is 080° to 090° and the metamorphic grade is greenschist facies.

New trenches have been blasted and old trenches (undocumented) have been cleaned out and reblasted south of Shannon lake (local name) on the Main and East zones of what is termed the Expansion Lake Occurrence. The Main zone has been exposed for a width of 25 m (84 feet). Mineralization is associated with strongly foliated and sheared polymictic conglomerate. Foliation strikes 085° to 090° and dips 87°S. Minor mafic metavolcanics may be present, but chlorite-rich rocks are believed to be the product of chloritization of the conglomerate and a portion of a multiphase alteration halo that includes carbonization and silification. A felsite dike intrudes the "Main zone" area at Shannon lake. Quartz and quartz-carbonate veins, up to 30 cm wide, occur in the shear zones. Disseminated pyrite (2 to 5 percent) occurs along shear planes. Grab samples assay up to 0.22 ounce gold per ton (P. Lassila, Consulting Geologist, Caviar Resources Ltd., personal communications, 1988).

Missing Link Occurrence

The Missing Link Occurrence is located in the southern portion of Lapierre Township and the northern portion of Legault Township, immediately north of Jory Lake. The property is accessible from the Kinghorn Road via an old bush road at a point approximately 8 km (5 miles) north of Highway 11. One hundred and forty-eight claims cover the Missing Link Occurrence and are held by Nolan Cox (Prospector, Beardmore). Trenching estimated to be over 30 years old has been located, but it is not documented in the geological literature. Trenching, linecutting, mapping, sampling, and geophysics have been undertaken in the last two years.

The Jory Lake-Lapierre Township area is underlain by intermediate to mafic metavolcanic rocks in fault contact with metasediments to the south. Metasediments consist of polymictic conglomerate and feldspathic sandstone (Mackasey, Edwards, and Cape 1976). Regional foliation trends approximately 080° and younging directions in pillows west of Jory Lake is to the south. A major 080°-striking lineament extends through Jory Lake and may be the eastern extension of the Paint Lake Fault—a major transcurrent fault.

Gold mineralization is associated with sheared and altered, mafic metavolcanics north of Jory Lake known as the Missing Link Occurrence. The shear zone is estimated to be 60 m (200 feet) to 90 m (300 feet) wide with present exposure. Disseminated, foliation-parallel, euhedral pyrite and arsenopyrite, within zones of both shearing and quartz-carbonate veining, host the gold mineralization. Pervasive carbonatization and more local and erratic silicification are also present. An altered diorite unit may be present apparently within the limits of the shear zone.

The North zone, Shaft Pit, and Baseline Trenches have been sampled to date. The North zone strikes 085° and dips 061°S. The property vendor has received assay values of up to 0.256 ounce gold per ton across 1.8 m (6 feet) on the North zone (Nolan Cox, Prospector, Beardmore, personal communication, October 5, 1988).

Grab samples collected by the authors from all pits and trenches on the property assayed up to 0.14 ounce gold per ton (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

N.W.T. (Giant Gripp) Copper Mines Base Metal Deposit

In 1988, Granges Exploration Ltd. initiated a multiphase exploration program on the N.W.T. (Giant Gripp) Copper Mines base metal deposit. The Giant Gripp Deposit is located 72 km (45 miles) west–northwest of Nakina and is accessible via float plane to Marshall Lake and thenceforward by drill roads. Granges Exploration Ltd. holds approximately 400 claims. A program including 170 km of linecutting, VLF–electromagnetic surveying, magnetometer surveying, gradiometer surveying, geological mapping, stripping, sampling, and diamond drilling was undertaken.

Teck Corporation discovered copper–zinc mineralization in the Marshall Lake area in 1954. Soon after Teck Corporation's discovery, Billiton Company discovered what today is the main surface occurrence located just southwest of the western end of Marshall Lake. Over the years, N.W.T. Copper Mines Limited, Jacobus Mining, Kendon Copper, St. Joseph's Exploration, Imperial Oil Limited, Sherritt Gordon Mines Limited, and Corporation Falconbridge Copper conducted geophysical and diamond–drill programs on the Giant Gripp Deposit and other numerous copper–zinc–silver occurrences in the Marshall–Gripp lakes area.

The Marshall–Gripp lakes area is located within the Onaman–Tashota belt—predominately a thick sequence of felsic to intermediate pyroclastic rocks and associated derived metasedimentary rocks. The metavolcanic sequence is in contact to the north and east with a sulphide–oxide–facies banded iron formation (pyrrhotite–pyrite–magnetite) (Amukun 1985).

G. Wells, Corporation Falconbridge Copper (Resident Geologists's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay) described the intrusive rocks:

> "The Summit Lake tonalite found in the western part of the property, a syenitic plug possibly related to the Summit Lake pluton, north–south striking diabase dykes and east–west striking gabbro dykes, all intrude the metavolcanics."

S.E. Amukun (1985) stated:

> "Based on distribution of pumice-fall deposits and coarse-grained pyroclastic rocks, the metavolcanic pile is probably a product of several centres...Submarine and/or subaerial pyroclastic episodes probably produced bedded tuffs, and local lenses of coarse breccias near eruptive centres. Ash flows were recognized only by the presence of pumice fragments and highly vesicular rocks."

N. Baker, Imperial Oil Limited (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay) described the volcanic pile:

> "The volcanic pile is approximately 2000 m (6600 feet) thick. However regional mapping indicates that the volcanic sequence is continuous...and may attain a thickness of 7.2 km (4.5 miles)."

Metavolcanic rocks have been metamorphosed to upper greenschist and amphibolite facies grade.

Alteration in the Marshall–Gripp lake area has been described by Amukun (1985):

> "In the...area a distinctive suite of the metamorphic minerals staurolite, kyanite, sillimanite, andalusite is found in close proximity to the main concentrations of mineralization. It is probable that areas of concentration of these aluminosilicates represent zones of hydrothermal alteration resulting in alkali leaching and deposition of the sulphide mineralization."

Massive to disseminated copper–zinc–lead–silver mineralization, in the Marshall Lake area, occurs (associated with coarse–grained, intermediate to felsic pyroclastic breccias and felsic tuff) in several linear zones or lenses that parallel foliation, defining numerous discrete occurrences. Lenses have been noted at various horizons within the volcanic piles, associated with coarse–grained pyroclastic rocks in each case, suggesting that mineralization is stratabound.

The Giant Gripp Deposit has an indicated reserve of 2 211 000 tons averaging 1.22 percent copper, 4.20 percent zinc, 2.45 ounces silver per ton, and 0.012 ounce gold per ton (Canadian Mines Handbook 1988—89, Northern Miner Press Limited, p.348)

The copper–zinc–silver deposit is made up of a series of individual lenses or pods in plan view, and which are rod shaped in section. A folded stratigraphic horizon (felsic tuff) hosts the deposit and has been identified over a strike length of 6 km (3.6 miles) (M. Kreczmer, Exploration Manager, Granges Exploration Ltd., Timmins, personal communication, 1988).

Nineteen drill holes totalling approximately 3000 m (10 000 feet) were drilled in 1988. Drill hole N12 intersected 13.51 m (44 feet) assaying 8.95 percent zinc, 1.44 percent copper, 98.89 g/t silver and 0.083 ounce gold per ton (2.85 g/t) in the main zone area. Granges Exploration Ltd.'s plans for 1989 include drill testing electromagnetic conductors within the felsic tuff horizon as well as mapping and prospecting in the Gripp Lake area (M. Kreczmer, Exploration Manager, Granges Exploration Ltd., Timmins, personal communication, 1988)

FORT HOPE AREA

General Geology and Structure

The Fort Hope area westward to Miminiska Lake is within the eastern portion of the Uchi Subprovince—an east–trending, predominately metavolcanic–metasedimentary belt.

The Miminiska Lake area is underlain by a metasedimentary sequence of wacke, sandstone, and oxide-, carbonate-, and silicate-facies iron formation. The metasediments overlie a pillowed to massive, mafic metavolcanic sequence. A second mafic metavolcanic unit is located north of the metasediments. A thin unit of coarse-grained clastic metasediments (conglomerate, possibly sandstone, and arenite) occurs in the western part of the area. Quartz monzonite to granodiorite plutons intrude the metasedimentary-metavolcanic sequence. Diabase, feldspar porphyry, quartz-feldspar porphyry, and pegmatite dikes cut the metavolcanics (Wallace 1981).

The Opikeigen Lake-Fort Hope area to the east of the Miminiska Lake area has been described by Wallace (1978):

> "Alternating units of felsic metavolcanics (including rhyolitic to dacitic, fine to coarse pyroclastic rocks and massive and autobrecciated flows) and metasediments (including wackes, argillite and derived schists, quartzite and conglomerate) with minor bands of mafic metavolcanics are overlain by a thick accumulation of predominately mafic metavolcanics (including basaltic to andesitic, massive and pillow lavas, amphibolite schist agglomerate, autoclastic breccia and Algoma-type iron formation). This sequence has been tightly folded into an east-west-trending belt about 13 km (8 miles) wide, bounded to the south by migmatized metasediments and paragneiss, and to the north by a granodioritic batholith. Much of the northwestern part...is underlain by a circular diapiric intrusion of quartz monzonite and granodiorite about 8 km (5 miles) in diameter..."

Gold Deposits

There are seven gold-deposit types in the Fort Hope area: a) gold-antimony veins within shear zones (Howells Lake); b) gold-associated, arsenopyrite-rich iron formations (Goss Lake Prospect); c) gold-tungsten veins and related shear zones hosting auriferous pyrite-pyrrhotite mineralization (Reserve Creek Occurrences); d) gold mineralization with strongly foliated to sheared and mylonitized mafic to felsic metavolcanics (Eabamet Lake area); e) gold mineralization within silicified-carbonatized clastic metasedimentary rocks (Miminiska Lake area); f) quartz-tourmaline-gold veins (Miminiska Lake area); and g) feldspar±quartz porphyry intrusions hosting shear- and vein-associated gold mineralization (Keezhik Lake-Fort Hope-Miminiska Lake area).

Opikeigen Lake Project

M. Taylor (Senior Project Geologist, Noramco Explorations Inc.) (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay) described the Opikeigen Lake Project:

> "The Opikeigen Lake property consists of 340 claims located 13 km northwest of Fort Hope. Noramco Explorations has been exploring the property on behalf of Golden Lake Resources and Pure Gold Resources since 1986.
>
> The property is underlain by a folded sequence of metavolcanics and metasediments trending east along an anticlinal axis. A northern unit of mafic to intermediate tuffs with interbanded iron formations is flanked to the south by a central belt of metasediments. The metasediments are overlain to the south by felsic to intermediate tuffs and mafic pillow lavas. This southern volcanic unit hosts three gold deposits on the Opikeigen Lake property as well as the Fort Hope Gold Mine on an adjoining property. The most significant gold discoveries are zones OL-12 and OL-29.
>
> In zone OL-12, gold is associated with quartz veining and shearing in a sulfide horizon near the contact between mafic tuffs and mafic pillow lavas. Seven holes have tested the zone over a strike length of 25 m and to a depth of 200 m. The best gold intersections include 12.83 g/T gold over 1.5 m in hole 12, 7.57 g/T gold over 5.2 m in hole 42; 3.42 g/T gold over 1.8 m in hole 44 and 6.12 g/T over 7.0 m in hole 46.
>
> Zone OL-29 was tested by nine holes over a strike length of 425 m. Gold occurs with disseminated pyrite in a sericite-carbonate alteration zone near the sheared contact between intermediate tuffs and felsic crystal tuffs. The averaged gold intersections are summarized below.

GOLD INTERSECTIONS Hole No.	ZONE OL-29 Au Averaged Interval
OL-29	1.91 g/T/6.0m
OL-30	1.97 g/T/2.0m
OL-31	1.17 g/T/5.9m
OL-32	0.36 g/T/1.5m
OL-35	1.83 g/T/1.5m
	1.09 g/T/4.8m
OL-36	1.74 g/T/9.1m
OL-37	2.24 g/T/15.1m
OL-38	1.54 g/T/4.8m
OL-43	1.25 g/T/2.1m

> The stratabound nature of the mineralization and broad intersections indicate a large tonnage potential. The zone is open along strike and at depth."

RESEARCH BY RESIDENT OFFICE STAFF

HISTORICAL RESEARCH PROJECT

The Historical Research Project is funded by the Canada-Ontario 1985 Mineral Development Agreement (COMDA). The objectives of the Historical Research Project are to a) document old and forgotten gold occurrences and prospects, mainly in the Beardmore-Geraldton area; b) attempt to locate these old occurrences and prospects in the field, and, if found, try to evaluate their mineral potential; and c) provide the information gathered to prospective clients in readily researchable file or data base format.

The project involves the in-depth search of the old literature (The Northern Miner, mining journals, newspapers, magazines, government reports, etc.) for information on mineral occurrences in the Thunder Bay Mining Division. Each article is copied, ref-

TABLE 6.2. HISTORICAL RESEARCH PROJECT: ARTICLES RESEARCHED.

	Source Articles	Dates of Articles
1.	a) Canadian Mining Review	1883-1907
	b) Canadian Mining Journal	1908-1930 1936-1960
2.	The Pre-Cambrian	1932-1958
3.	The Daily Sentinel and North Shore Miner	1882, 1884-1890
4.	Thunder Bay Sentinel	1879-1893
5.	The Weekly Herald and Lake Superior Mining Journal	1882-1887
6.	The Weekly Herald and Algoma Miner	1889-1895
7.	The Daily Journal	1895-1899
8.	The Fort William Daily Times Journal	1900-1930
9.	The Weekly Times Journal	1903-1905
10.	The Morning Herald	1909, 1912
11.	The Northern Miner	1915-1945
12.	The Engineering and Mining Journal	1881-1902
13.	Gold Magazine of Canada's North	1933-1939

erenced, map located (if possible), and filed by property name in both alphabetical and NTS formats.

In 1988, research was concentrated in the Beardmore-Geraldton-Longlac area. The Northern Miner articles researched covered the dates from January 1939 through to December 1945.

The following is a list of sources that have been searched to date since the project's inception in 1981 by K.G. Fenwick (Regional Mineral Resources Co-ordinator (1981), North Central Region, Ontario Ministry of Natural Resources).

The project thus far has had some success, but difficulties arise due to a) the vague descriptions of the nature and locations of some of the properties in the articles and reports; b) the time frame involved (i.e., some of the mineral occurrences record exploration that is 50, or more, years old and therefore old workings are difficult to identify in the field—they may be completely overgrown with vegetation or filled with debris, etc.). However, two examples of old unstaked properties, which indicated possible gold values, were researched through this project and subsequently staked. They are the Foisey Occurrence and the Jedder Gold Mines Limited (Deraugh) Occurrence.

The Foisey Occurrence

The Foisey Occurrence consists of nine staked claims (TB 1068900 to TB 1068904 and TB 1069053 to TB 1069056) held by F. Houghton and F. Checkley (prospectors, Beardmore), and is located in the northwestern portion of Rickaby Township. The claims are situated between Kaby and Dilla (formerly Dillabough) lakes and are accessible by bush road northward from the Kinghorn Road at a point 22 km from Highway 11. The property was originally staked in October 1926, by Frank Foisey and saw limited surface exploration. In May of 1988, the property was rediscovered by Frank Houghton (Prospector, Beardmore) through articles contained in the The Northern Miner and the Canadian Mining Journal and was then restaked. Freewest Resources Inc. and Murgor Resources Inc. subsequently optioned the property and conducted an exploration program including linecutting, stripping, geological mapping, channel sampling, geophysical (VLF and magnetometer) and geochemical surveys. Diamond drilling will follow.

The following are excerpts from the original newspaper articles (The Northern Miner, June 29, 1933, p.9):

> "Following a gold find by Frank Foisey, staked for a syndicate of Sudbury and Shining Tree men, quite a number of claims have been located by Port Arthur and other groups near Onaman Lake, near Jellicoe on the C.N.R.. This is the second discovery near Jellicoe in the past few weeks, the first having been made by T.A. Johnson, well known as the finder of Little Long Lac Gold Mines discovery vein. The Foisey find is said to be up to 15 ft. wide and carrying values up to $13."

The original description of the property was given by E.M. Burwash (Canadian Mining Journal, November 1933, p.436):

> "Foisey—Claim T.B.11048 west of Dillabough lake, has a fractured zone, in granite mainly. It is of good width and has been traced for over 850 feet. There is a fault-displacement of about 60 feet, horizontally along a SW-NE plane at one point. The fractured material is mainly granite, but includes greenstone inclusions, in the granite, lamprophyre dikes, and feldspar porphyry dikes. The fragments are surrounded and partly displaced by quartz which fills the interstices between them and sometimes has a width of 4 to 6 inches between fragments. The mineralization is pyrite, chalcopyrite and molybdenite, and the quartz is mainly sugary in appearance. Values up to $6.75 across 5-foot widths are claimed for this ore. At the discovery point, where the fracture-zone traverses a lamprophyre dike, picked samples of from $12.00 to $18.00 tenor were obtained, and the channel samples there are said to carry from $4.50 to $7.50 in gold. In some parts of this fracture zone feldspar occurs in the injected vein-matter and the vein takes on the character of a pegmatite. The strike of this vein is about 135° (S45°E). The lamprophyre dike which it intersects strikes N80°E. At the northern end of the fracture zone a very large mass of the fractured and injected rock is exposed, the structural boundaries of which were not clearly observed."

The Foisey Occurrence (Kaby and Dilla lakes area) is underlain by the Kaby Lake Stock. The Kaby Lake Stock consists of "massive pink to light grey granodiorite to trondhjemite with local occurrences of granite and quartz monzonite" (Mackasey and Wallace 1978). The intrusion is in contact with intermediate metavolcanic rock to the east and south of the Foisey Occurrence. Tuff breccia and breccia constitute the metavolcanics. Three lineament sets have been noted in the Kaby Lake Stock including a northeasterly, easterly, and northwesterly set.

The Foisey (Main) Occurrence consists of brittlely fractured and silicified granodiorite and quartz diorite. The occurrence, parallels the northwesterly lineament trend, strikes 135° and is 140 m (460 feet) by 8 to 10 m (27 to 33 feet) wide. Mafic to intermediate metavolcanic rocks, in the form of xenoliths up to 50 m in diameter, and lamprophyre dikes occur on the property. Multiple generations of quartz veining have been injected into fractures in the granodiorite and quartz diorite. An open breccia texture has resulted. A second set of quartz veins, striking northerly, is intimately associated with the gold mineralization (M. Atkins, Geologist, Freewest Resources Incorporated, Montreal, personal communication, 1988).

Gold mineralization is associated with fine- to medium-grained, euhedral to subhedral pyrite and minor chalcopyrite and molybdenite. The pyrite is relatively ubiquitous but more readily is associated with fragments of granodiorite on the margins of discrete veins or very silicified granodiorite itself that displays potassium alteration. Typically one to two percent pyrite was noted. Five distinct gold occurrences have been found to date on the Foisey–Houghton claims including the Foisey (Main) Occurrence. The other four occurrences are named the a) North, b) Swamp (mylonite), c) Boundary, and d) 2 North (line). All occurrences strike 130° to 135°.

Channel sampling by Freewest Resources Incorporated assayed up to 5.4 m (18 feet) of 0.0593 ounce gold per ton (M. Atkins, Geologist, Freewest Resources Incorporated, Montreal, personal communication, 1988). Grab samples assayed up to 0.62 ounce gold per ton (Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay).

The Jedder Gold Mines (Derraugh) Occurrence

Reference of gold values related to a copper showing north of Pikitigushi Lake (formerly Round Lake) was found in the following The Northern Miner newspaper clipping (The Northern Miner, March 3, 1938, p.9):

> "J.E. Derraugh, field manager to Jedder Gold Mines Limited is en route to the company's property at Round Lake, due north of Lake Nipigon in the Kowkash area with a crew of men and supplies. The Derraugh discovery was made late last fall and chip samples returned gold values of $7 over 4.5 ft. ; $5.60 over 4.5 ft. ; $18.20 over 4.5 ft. ; $1.75 over four feet; and $4.20 over four feet. Following the erection of camps, the discovery pits will be blasted to permit systematic channel sampling and extensive trenching will be carried out preparatory to a diamond drilling campaign."

A group of twenty-seven claims were staked in April 1988 to cover the showing after explorationists read the March 31, 1938 clipping from The Northern Miner. Further exploration will follow on the claim block.

RECOMMENDATIONS FOR EXPLORATION

GOLD

Over 94 percent of the gold produced from the Beardmore–Geraldton camp was associated with the Southern Metasedimentary sub-belt of the Beardmore–Geraldton belt and was hosted in veins, breccia zones, shear zones, and replacement iron-formation-related sulphides.

Within the Beardmore–Geraldton belt, major transcurrent faults, including the Bankfield–Tombill lithotectonic zone (Bankfield–Tombill Fault) and the Paint Lake Fault and associated splay faults, should be examined. These deformation zones (that may appear as lineaments on geological maps) have the potential for hosting gold mineralization, and should be explored by prospecting, magnetometer surveys, VLF surveys, satellite imagery, and aerial photographs. Alteration zones of carbonate, silica, potassium, and/or hematite associated with sulphide minerals (mainly pyrite) can occur associated with gold in such structures. Discovery of the Missing Link Occurrence (1986) and Expansion Lake Occurrence lend support to the model. Fault-generated feldspar porphyry and gabbro intrusives should be explored. Gold can be associated with disseminated pyrite and arsenopyrite and/or stockwork vein systems in the intrusions. Examples of these fault-generated intrusions include the MacLeod–Cockshutt albite porphyry, and the Talmora gold mine gabbro.

A follow-up evaluation of high-resolution aeromagnetic vertical and total-field data (GSC Open File 1825) could identify folded or faulted oxide-facies banded iron formation and replacement sulphide associated auriferous dilatant zones.

Vein-type gold occurrences should be re-evaluated. The reopening of the Ateba Mines Inc. Pan-Empire Mill at Beardmore will permit custom gold milling and bulk sampling. Exploration, using a combination of diamond drilling and bulk sampling on "nugget-effect" veins, is recommended. Quartz-carbonate vein deposits, mineable by surface methods and, ultimately, by decline, are present. The theme to be reinforced is "mine ounces not tons", emphasizing the high-grade (0.4 ounce gold per ton) nature of the many veins in the Beardmore–Geraldton area.

Areas of glacial till cover in the Beardmore–Geraldton area, particularly west of Geraldton, masking rocks with high potential for gold mineralization should be prospected using till sampling for pathfinder elements and gold. Backhoe, reverse circulation drilling, and (or) sonic drilling samples could be analyzed for boron, antimony, arsenic, tungsten, gold, silver, zinc, copper, and lead. Recent till–stratigraphy and geochemistry data (Kristjansson and Thorleifson 1987; Kristjansson, White, and Sado 1988; Thorleifson and Kristjansson 1988) emphasizes the need for till exploration. Within the Onaman–Tashota belt, felsic stocks and batholiths should be evaluated for quartz–flooded, auriferous, brittle–fracture zones. The rediscovery of the Foisey Occurrence has suggested that the Kaby Lake, Coyle Lake, and Elmhirst Lake stocks should be prospected.

BASE METALS

Current base–metal price trends suggest a return to exploration for copper–zinc–silver and lead–zinc volcanogenic massive sulphide deposits. The Marshall Lake–O'Sullivan Lake area and the Onaman River area of the Onaman–Tashota belt have high mineral potential for base metals (Note: Amukun (1985) re–interpreted metasedimentary rocks as felsic to intermediate pyroclastic rocks in the Marshall Lake area.).

The 1989 scheduled release of an Ontario Geological Survey airborne electromagnetic—magnetic survey covering the Onaman–Tashota belt and Beardmore–Geraldton belt could define potential base–metal target areas. Fully integrated base–metal exploration programs, including geophysical surveys, geological surveys, regional lithogeochemical surveys, downhole geophysical investigations, alteration studies, and diamond drilling, are recommended.

Finally, a chloritoid alteration zone has been noted by S. Osterberg, University of Minnesota, Duluth (J.M. Franklin, Geological Survey of Canada, Ottawa, personal communication, 1984) in the Onaman River area. Deposits such as the Headvue (Headway–Coulee) zinc–lead–silver deposit and other known base–metal occurrences are located within this alteration zone. This area should be re–explored.

ONTARIO GEOLOGICAL SURVEY AND COMDA–FUNDED ACTIVITIES

The Ontario Geological Survey conducted, under contract, an airborne electromagnetic—magnetic survey of the Beardmore–Geraldton belt and Onaman–Tashota belt. This survey is scheduled to be released in 1989.

Four research and (or) mapping programs were funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by governments of Canada and Ontario. These are as follows:

1. Allan Speed, Susan Gaudino and Gail Jackson continued with the Historical Research Program in the Beardmore–Geraldton area.
2. David Kresz and Boris Zayachivsky (Geologists, Precambrian Geology Section, Ontario Geological Survey, Toronto) mapped the Seagram Lake area east of Longlac, Ontario.
3. F.J. (Rik) Kristjansson (Geologist, Engineering and Terrain Geology Section, Ontario Geological Survey, Toronto) completed a Quaternary mapping project in the Geraldton area.
4. Howard Williams (Geologist, Precambrian Geology Section, Ontario Geological Survey, Toronto) completed a study of the tectonic evolution of the Beardmore–Geraldton area with emphasis on the boundary between the Wabigoon and Quetico subprovinces.

RESEARCH BY OTHER AGENCIES

Lakehead University, Thunder Bay, continued with two MSc geology theses projects in the Beardmore–Geraldton area: a) "Sedimentological Processes Operative in Glacial Deltaic Settings" by Susan Gaudino; b) "Structural Study of the Beardmore Area: A Traverse from Paint Lake Fault to the Quetico Subprovince" by Peter Holmes.

K.Y. Soo, Brock University, St. Catherines, completed an MSc geology thesis entitled "Petrological and Geochemical Studies of Basic Rocks in the Beardmore–Geraldton belt, Northwestern Ontario."

L. Harvey Thorleifson, Terrain Sciences Section, Geological Survey of Canada, Ottawa, undertook further till studies including rotasonic drilling in the Geraldton and Beardmore areas.

ACKNOWLEDGMENTS

Gerry White undertook compilation of figures. Allan Speed and Susan Gaudino wrote the Historical Research Project (COMDA) section. Company exploration data was partially compiled by Susan Koski (Clerk Typist). Mark O'Brien (Data Folio Geologist) provided GDIF index information. Exploration personnel provided invaluable information. Cyndee Mack (Secretary) typed the report. Ken Fenwick (Manager, Mineral Resources, Northwestern Ontario Region, Ministry of Northern Development and Mines, Thunder Bay) reviewed the manuscript.

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7. Schreiber–Hemlo Resident Geologist's District—1988

B.R. Schnieders[1] and M.C. Smyk[2]

[1]Resident Geologist, Ministry of Northern Development and Mines, Thunder Bay.

[2]Staff Geologist, Ministry of Northern Development and Mines, Thunder Bay.

INTRODUCTION

The Schreiber–Hemlo District covers an area from the Nipigon River east to White River, and from the US–Canada border north to Upper Roslyn Lake and Kagiano Lake (*see* Figure 7.1). The area includes the communities of Rossport, Schreiber, Terrace Bay, Marathon, Heron Bay and Manitouwadge, and is adjacent to both Nipigon and White River. The district incorporates the Schreiber–Winston Lake, Hemlo and Manitouwadge mining camps, which presently host five producing mines. The David Bell Mine, Golden Giant Mine and Page–Williams Mine are the gold mines at Hemlo. The base–metal mines include the Noranda Inc., Geco Division mine in Manitouwadge (a 30–year producer) and the Minnova Inc., Winston Lake Division mine which was officially opened on July 27, 1988.

Exploration activity in the Schreiber–Hemlo District remained at a high level during 1988 with over 60 active programs for gold, base metals, platinum group elements and industrial minerals. Over 900 inquiries from the mining sector and general public were dealt with in the Thunder Bay office, Marathon field office and in the field. Several new occurrences were discovered, and others were rediscovered during 1988, including the Joa–Walton Occurrence in the Schreiber area (*see* Property Examinations section).

During 1988, the Ontario Mineral Exploration Program (OMEP) assisted four designated programs, with a total expenditure of approximately $850 000 in the Schreiber–Hemlo District.

ACKNOWLEDGMENTS

Technical support and assistance for this report was provided by M. O'Brien who prepared figures and tables representing GDIF (Geological Data Inventory Folio) coverage, and publications, in the Schreiber–Hemlo District. S. Koski prepared assessment file data, C. Mack typed the original draft and K.G. Fenwick reviewed the manuscript.

Numerous prospectors, geologists and individuals from the mining sector provided valuable information and discussion throughout 1988 and many are referenced throughout the text.

All analytical work was performed by the Geoscience Laboratories, Ontario Geological Survey, Toronto.

MINING ACTIVITY

Geco Division (Noranda Inc.)

Production from the Geco Division mine, Manitouwadge, from January 1988 through July 31, 1988, saw 889 619 tons (short) of copper–zinc–silver ore milled.

Diluted ore reserve estimates as of July 31, 1988 are listed below.

	Tons	Cu (%)	Zn (%)	Ag (oz/ton)
Main Orebody	10 330 927	1.78	3.44	1.32
4-2 Copper	2 109 717	1.99	0.66	0.65
8-2 Zinc	598 465	0.14	5.89	1.29
Zinc in Iron Formation (ZIF)	311 754	0.04	6.72	1.20

(H. Lockwood, Chief Geologist, Geco Division, Manitouwadge, personal communication, 1988)

Winston Lake Division (Minnova Inc.)

The Minnova Inc. Winston Lake Division mine produced its first concentrate in January 1988 and celebrated its official opening on July 27, 1988. The opening ended a ten–year cycle from project proposal, through exploration and development, to production.

Production for the period January 1988 through October 31, 1988 was 212 972 t at a grade of 0.82 percent copper, 16.54 percent zinc, 30.5 g/t silver and 0.75 g/t gold.

Reserve estimates, which include proven, probable and possible ore with a 20 percent dilution, are indicated at 2 684 379 t at a grade of 1.05 percent copper, 15.26 percent zinc, 31.37 g/t silver and 1.07 g/t gold. Estimated production in 1989 is 340 000 t of ore (R. Sim, Mine Geologist, Winston Lake Division, Schreiber, personal communication, 1988).

HEMLO AREA MINES

Combined gold production from the three Hemlo mines in 1987 was 756 291 ounces (Canadian Mines

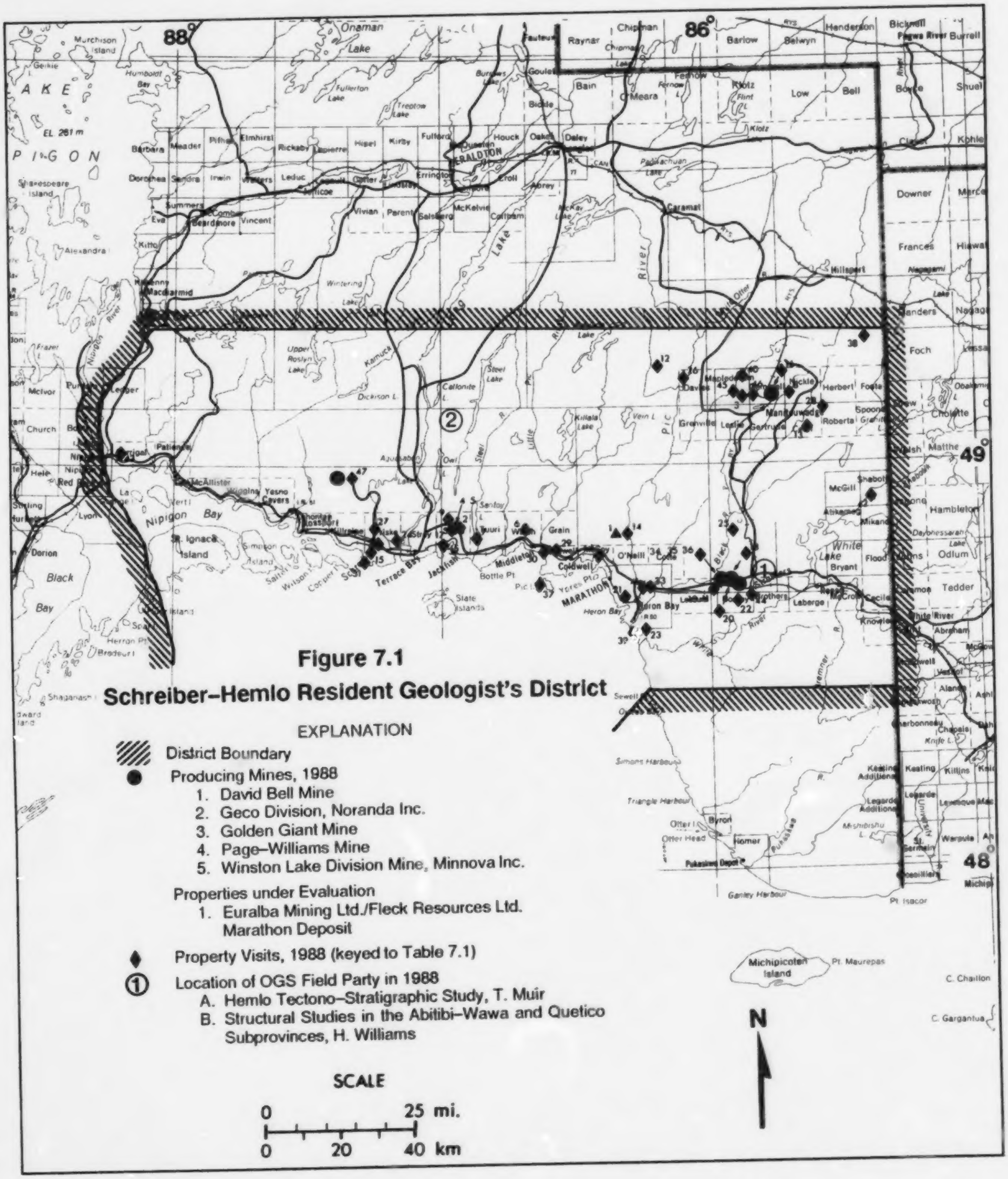
88°
86°
49°
48°
LAKE NIPIGON
Onaman Lake
GERALDTON
Beardmore
Macdiarmid
Nipigon
Red Rock
Nipigon Bay
St. Ignace Island
Black Bay
Schreiber
Terrace Bay
Jackfish
Marathon
Heron Bay
Caramat
Hillsport
Manitouwadge
White Lake
White River
Michipicoten Island
Pukaskwa Depot
Otter Head
Simons Harbour
Triangle Harbour
Ganley Harbour
Pt. Isacor
Pt. Maurepas
C. Chaillon
C. Gargantua
Sewell
Bottle Pt
State Islands
Pic I.
Heron Pt.
Herron Pt.
Bradeur I.
Shaganash I.
Murchison Island
Humboldt Bay
EL 261 m
Alexandra I.
Upper Roslyn Lake
Dickison L.
Wintering Lake
Kilkala Lake
Vein L.
Pic River
White River
Black R.
Pukaskwa
Steel Lake
Callonite L.
Killala Lake
①
②
N

Figure 7.1

Schreiber–Hemlo Resident Geologist's District

EXPLANATION

▨ District Boundary

● Producing Mines, 1988
1. David Bell Mine
2. Geco Division, Noranda Inc.
3. Golden Giant Mine
4. Page–Williams Mine
5. Winston Lake Division Mine, Minnova Inc.

Properties under Evaluation
1. Euralba Mining Ltd./Fleck Resources Ltd. Marathon Deposit

◆ Property Visits, 1988 (keyed to Table 7.1)

① Location of OGS Field Party in 1988
A. Hemlo Tectono–Stratigraphic Study, T. Muir
B. Structural Studies in the Abitibi–Wawa and Quetico Subprovinces, H. Williams

SCALE

0 25 mi.

0 20 40 km

Handbook 1988–89) which represented approximately 44 percent of Ontario's total gold production and 20 percent of Canada's total gold production. Both the Page–Williams Mine and Golden Giant Mine achieved full milling production capacity of 6000 and 3000 t per day, respectively, in 1988.

Combined gold production in 1988 from the three Hemlo mines is conservatively estimated to be 920 000 ounces of gold.

David Bell Mine (Teck-Corona Operating Corporation)

Production from the David Bell Mine from October 1, 1987 through September 30, 1988, consisted of 204 141 ounces of gold, from 375 393 t milled, at a grade of 0.56 ounce gold per t (0.51 ounce gold per ton) (P. Bankes, Chief Geologist, David Bell Mine, Hemlo, personal communication, 1988).

Mineable, diluted and recoverable ore reserve estimates as of September 30, 1987 were 6 463 600 t at a grade of 0.37 ounce gold per t (approx. 0.33 ounce gold per ton) (P. Bankes, Chief Geologist, David Bell Mine, Hemlo, personal communication, 1988).

Golden Giant Mine (Hemlo Gold Mines Inc.)

Production from the Golden Giant Mine from January 1988 through October 31, 1988 was 271 681 ounces of gold from 741 291 t milled at a grade of 11.79 g/t (0.34 ounce gold per ton) (B. Kusins, Chief Geologist, Golden Giant Mine, Hemlo, personal communication, 1988). The average grade for the same period in 1987 was 13.25 g/t (0.39 ounce gold per ton). Total production for 1988 is estimated to be 375 000 ounces of gold.

Ore reserve estimates as of December 31, 1987 were 18 600 000 t at a grade of 9.9 g/t (0.29 ounce gold per ton) (B. Kusins, Chief Geologist, Golden Giant Mine, Hemlo, personal communication, 1988).

Page–Williams Mine

Production from the Page–Williams Mine from January 1988 through October 31, 1988 was 305 797 ounces of gold from 1 191 705 t milled at a grade of 7.98 g/t (0.23 ounce gold per ton) (B. Weicker, Chief Geologist, Page–Williams Mine, Hemlo, personal communication, 1988).

The Page–Williams Mine attained full mill capacity of 6000 t per day in the fourth quarter of 1988. Total production for 1988 is conservatively estimated to be 385 000 ounces of gold.

Undiluted ore reserve estimates for the Page–Williams Mine total 35 300 000 t at a grade of 6.6 g/t (0.19 ounce gold per ton). The breakdown of ore reserves is listed below.

Zone	Ore Reserves (t)	Grade (g/t)
A-Zone	1 000 000	6.9
B-Zone	31 000 000	6.8
C-Zone: Pit	1 700 000	4.1
Underground	1 600 000	5.1
Total	35,300,000	6.6

(B. Weicker, Chief Geologist, Page-Williams Mine, Hemlo, personal communication, 1988)

ADVANCED EXPLORATION AND DEVELOPMENT

Euralba Mining Ltd.–Fleck Resources Ltd.

Euralba Mining Ltd. (51 percent) and Fleck Resources Ltd. (49 percent) continued their evaluation of the Marathon copper–platinum group element property. A geostatistical evaluation of ore reserves was performed by Geostat Systems Inc. of Montreal. Broken Hill Proprietary is conducting a pre-feasibility study involving ore reserve calculations and metallurgy, engineering and mine plan studies formulated around a 55 million ton orebody.

EXPLORATION ACTIVITY

Exploration activity in the Schreiber–Hemlo District remained at a high level during 1988 involving over 60 active programs (*see* Table 7.3, Figure 7.3) for gold/silver, base metals, platinum group elements (PGE), rare earth elements and industrial minerals. A shift in exploration away from PGE and towards base metals and industrial minerals was noted in 1988 (*see* Table 7.1.).

A summary of the claims recorded and assessment work for the Thunder Bay Mining Division is available in Table 5.1, Lavigne *et al.* (this volume).

Several new occurrences were discovered and rediscovered in late 1987 and 1988, including gold occurrences such as the Joa–Walton and Observation Point properties and the Shabotik copper–nickel–PGE occurrence (*see* Property Examinations section).

TABLE 7.1. EXPLORATION ACTIVITY IN THE SCHREIBER-HEMLO RESIDENT GEOLOGIST'S DISTRICT (expressed as percentage of programs).

COMMODITY	1987	1988
Au, Ag (precious metals)	70%	61%
Base Metals	14%	18%
Platinum Group Elements (PGE)	14%	9%
Industrial Minerals, Building Stone and Rare Earth Elements	2%	12%

GOLD EXPLORATION

The Cirrus Lake–Hemlo–Heron Bay area remains the most active area for gold exploration with over 20 active exploration programs. While much of the metavolcanic and metasedimentary rocks remained staked, numerous claim groups have come open during 1988 and have been restaked.

Hemlo Gold Mines Inc. remained the most vigorous exploration company in the Schreiber–Hemlo District with seven exploration programs in the Hemlo area (*see* Table 7.3).

Deep diamond drilling on the International Interlake Industries Inc. Property intersected 29.5 feet grading 0.258 ounce gold per ton in Hole No. IL–6 at a drillhole depth of 7995.3 to 8024.8 feet (The Northern Miner, September 19, 1988, page 27). Deep diamond drilling programs designed to obtain stratigraphic cross sections and to test for along–strike and downplunge extensions to the main Hemlo deposit and parallel mineralized zones are in progress from the International Interlake, Golden Goliath and Golden Sceptre properties.

Lac Minerals Ltd. continued exploration on its White River Prospect in Bomby, Brothers and Laberge townships, with a program of linecutting, geological mapping, geophysical surveys and diamond drilling.

Exploration on the Page–Williams Mine included 4000 m of diamond drilling and sampling on the C–Zone. The C–Zone will become part of a 30 000 000 t backfill waste quarry which will include approximately 2 000 000 t of recoverable ore (B. Weicker, Chief Geologist, Page–Williams Mine, Hemlo, personal communication, 1988).

Esso Minerals Canada conducted linecutting, geological mapping, geochemical and geophysical surveys as well as stripping and sampling on the Bel–Air, Harlin, Caulfield and Dakota properties.

In the Heron Bay area, Teck Corporation carried out an underwater induced polarization (IP) survey on the Heron Bay Property. V. Stenlund is still planning to list a company and conduct an extensive drilling program on the Peekongay–Heron Bay Mine.

In the Schreiber–Terrace Bay area, Beardmore Resources Ltd. conducted diamond drilling and sampling on the Gold Range and Hays Lake properties. Noranda Exploration Company, Limited conducted reconnaissance mapping and sampling in the Hays Lake–Worthington Bay area. Belmoral Mines Ltd. carried out linecutting, geophysical surveys (VLF electromagnetic, magnetic, IP), stripping, trenching and sampling on the Michano Option in the Dead Horse Creek area. Ansell Lake Resources Ltd. conducted linecutting and geophysical surveys (magnetic, VLF–EM, IP) on its base metals–gold property in Priske Township. Orevco Inc. plans to test and demonstrate small–scale milling equipment and technology in the Schreiber area during 1989.

BASE–METAL EXPLORATION

Base–metal exploration displayed a marked increase during 1988 and the trend is expected to continue for the next several years. With the opening of the Winston Lake Division Mine of Minnova Inc. and continued production from the 30 year producer, Geco Division of Noranda Incorporated, the Schreiber–Hemlo District has become well known for its volcanogenic massive sulphide base–metal potential.

The Winston Lake and Manitouwadge areas were the most active for base–metal exploration. Minnova Inc. and Geco Division (Noranda Inc.) have conducted programs based on integrated exploration models and methods that combine detailed geological mapping, lithogeochemical and geophysical surveys, followed by diamond drilling and downhole geophysical surveys.

Minnova Inc. continued work on the Winston Lake Property, Zenmac Option and Gesic Option. The Winston Lake property option includes the Pick Lake Zone which is considered to represent a parallel, satellite sheet deposit. Noranda Exploration Company, Limited and Cumberland Resources Ltd. were active in the Prairie River area which includes both the Marlhill and Prairie River West properties. Exploration consisted of linecutting, geological mapping, lithogeochemical and geophysical surveys, sampling and diamond drilling proposed for early 1989. The Victoria Lake property, which was also a joint venture of the two companies, remained inactive in 1988.

In the Manitouwadge area, Geco Division (Noranda Inc.) is actively exploring for base metals. During 1988, 32 284 feet (9783 m) of diamond drilling in 19 holes was completed on the Hucamp and Eastern Extension Options. Underground diamond drilling from the Geco Division Mine will continue in 1988 to test for down–plunge extensions of mineralized zones on the Willroy Mine. Reconnaissance mapping and lithogeochemical surveys are being conducted on the Faries Lake Property in Cecil Township and other selected areas throughout the belt.

PLATINUM GROUP ELEMENTS EXPLORATION

Exploration activity in the Coldwell and Killala Lake alkaline complexes decreased in 1988. Although Euralba Mining Ltd. and Fleck Resources Ltd. continued their pre–feasibility and evaluation of the Marathon Cu–PGE Property, the number of active exploration programs decreased in 1988. Bond Gold Canada Inc. (formerly St. Joe Canada Inc.) dropped the Geordie Lake Option (MacRae Occurrence). However, a large extensive zone of low grade copper–silver–palladium–tellurium mineralization has been outlined there.

Recent work by T. Mulja (MSc candidate, Lakehead University) has identified the host to the Geordie Lake mineralized zone as an ophitic olivine gabbro which varies to a harrisitic troctolite. The mineralization consists of chalcopyrite, bornite, cobaltite, chalcocite, niccolite, galena, sphalerite, pyrite, millerite , magnetite and ilmenite. Platinum group minerals are palladoarsenide (Pd_2As), michenerite (PdBiTe), paolovite (Pd_2Sn), kotulskite (PdTe), isomertieite ($Pd_{11}As_2Sb_2$) and sperrylite ($PtAs_2$), as well as several unnamed minerals (T. Mulja, MSc candidate, Lakehead University, Thunder Bay, personal communication, 1988). Mulja suggests that this mineralized zone represents a new type of PGE occurrence. It is a palladium-rich product of an evolved gabbro that has undergone deuteric alteration with associated ore mineral mobilization.

Other companies active in PGE exploration included BP Resources and Duration Mines Ltd.

One highlight for PGE exploration was the discovery or rediscovery of PGE in the Shabotik Township area. The property is described under the Property Examinations section of this report.

INDUSTRIAL MINERALS EXPLORATION

Seven exploration programs for industrial minerals; building and dimension stone, amethyst, silica and lithium, were active in the Schreiber–Hemlo District during 1988. A further discussion on Industrial Minerals can be found in this volume under Kennedy and Sherlock.

RARE EARTH ELEMENTS EXPLORATION

Rare earth element (REE) exploration was largely inactive during 1988. The Dead Horse Creek REE property option, under Unocal Canada Limited, lapsed.

Analytical results from samples of the Dead Horse Creek Occurrence taken by staff of the Resident Geologist's Office are shown in Table 7.2 with some comparative values from Thor Lake, Northwest Territories.

Figure 7.2 shows the chondrite–normalized REE distribution trends for the **87BUN**– samples from the Dead Horse Creek Occurrence.

Variations in the distribution and relative enrichments of light (La to Eu) and heavy (Gd to Lu) REE may be due to different REE–bearing minerals in the different samples. In local samples with high P_2O_5, for example, the presence of REE–bearing phosphate minerals such as monazite ($(La,Ce,Nd)PO_4$) and xenotime ($(Y,Gd,Dy,Er,Fe)PO_4$) will result in the concentration of light and heavy REE, respectively. Preliminary studies of mineralogy and REE geochemistry suggest that the REE occur in minerals which are favourable for extractive metallurgy such as xenotime (REE) and eudialyte (Zr) (Schnieders *et al.* 1988).

The marked lack of a europium anomaly in any of the samples suggests strongly oxidizing fluid conditions; this is correlative with the pervasive hematization of the local rocks. It is believed that this diatreme–hosted occurrence has a carbonatite affinity; fenitization (alkali metasomatism) may be an important alteration characteristic.

Ongoing studies in conjunction with R.P. Taylor, Carleton University, Ottawa, will serve to identify the REE–bearing mineralogy as related to the geochemistry and geology. Further discussion of REE can be found in this volume under Kennedy and Sherlock.

GENERAL GEOLOGY

The Schreiber–Hemlo District is underlain by Early to Late Precambrian rocks. The Archean rocks rep-

TABLE 7.2. RARE EARTH ELEMENT ANALYSES OF THE DEAD HORSE CREEK OCCURRENCE.

SAMPLE NO.	BERYLLIUM (ppm)	YTTRIUM (ppm)	RARE EARTH ELEMENTS (%)	NIOBIUM (ppm)	ZIRCONIUM (ppm)
87BUN-01	6170	98	0.125	300	11.6%
87BUN-02	150	32	0.022	125	2.4%
87BUN-03	240	36	0.022	100	2.8%
87BUN-04	20	140	0.073	110	1200
87BUN-05	8	235	0.122	180	1300
THOR LAKE, NORTHWEST TERRITORIES*	**BeO (%)**	**Y_2O_3 (%)**	**REEO (%)**	**Nb_2O_5 (%)**	**ZrO (%)**
Lake Zone	--	--	1.99	0.57	4.73
North T-Zone	1.11	0.17	0.28	0.58	--

**Highwood Resources Limited Annual Report, 1986*

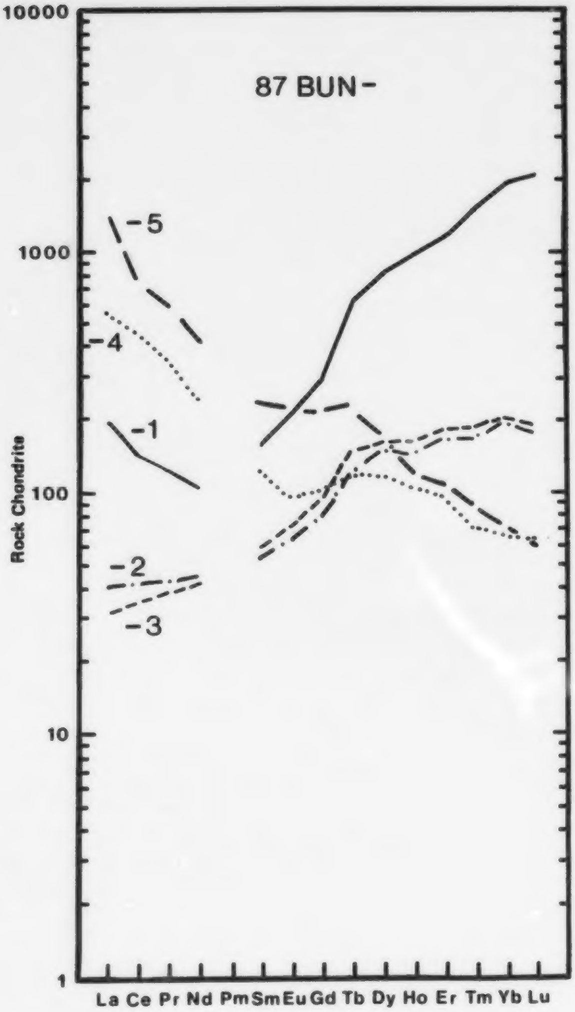

Figure 7.2. *Chondrite-normalized REE plot, Dead Horse Creek samples.*

resent a portion of the Abitibi–Wawa belt of the Superior structural province in contact with the Quetico Subprovince in the extreme northern section of the area. The Abitibi–Wawa is a supracrustal metavolcanic–metasedimentary sequence which has been intruded by granitic–syenitic plutons and metagabbroic dikes and sills.

The supracrustal rocks occur in three "main" belts within the Schreiber–Hemlo District: 1) the Schreiber–Terrace Bay–Winston Lake area, previously described by Marmont (1984), Severin and Balint (1985), and Patterson *et al.* (1987); 2) the Cirrus Lake–Heron Bay–Hemlo area, previously described by Milne (1967), Muir (1982a, 1982b) and Patterson (1984); and 3) the Manitouwadge area, previously described by Pye (1960) and Friesen *et al.* (1982).

The metavolcanic rocks within the Schreiber–Hemlo District vary from calc–alkalic pyroclastic rocks, breccias, tuffs, flows, porphyritic flows, schists and gneisses to mafic, iron–rich tholeiites which include pillowed and massive flows, tuffs, schists and gneisses. The metasedimentary rocks consist of graded turbidites, wackes, mudstones, schists, paragneisses, minor conglomerates and iron formation. Sulphide–facies iron formation predominates in the Schreiber–Terrace Bay area while oxide–silicate facies appears to predominate in the Manitouwadge area. Numerous felsic batholiths, plutons, stocks and porphyry dikes, including the Terrace Bay batholith, Heron Bay pluton and Cedar Lake pluton, intrude the supracrustal rocks. The supracrustal rocks have been metamorphosed under low grade (greenschist facies) conditions in the Schreiber, Jackfish, Big Duck and Heron Bay areas; under medium grade (amphibolite facies) in the Winston Lake and Hemlo areas; and under medium to higher grade (upper amphibolite facies) in the Manitouwadge area.

The supracrustal rocks have undergone up to four periods of deformation (Muir and Elliot 1987). Two periods of folding are evident in the Hemlo area while evidence of multiple or complex folding events is present in the Lower Steel River area (Schnieders 1987). Large–scale, faulting and deformation zones have been recognized in the Hemlo area by Page (1947), Bartley and Page (1958), Hugon (1984, 1986) and Muir and Elliot (1987); in the Big Duck Lake area by Williams (1986, 1987); and in the Jackfish–Middleton area by Williams (1987) and Schnieders (1987).

Middle Precambrian rocks unconformably overlie the Early Precambrian rocks. The Gunflint and Rove Formation sedimentary rocks consist of conglomerate, black shale and Superior–type iron formation.

Late Precambrian sedimentary rocks unconformably overlie Early and Middle Precambrian rocks. The Sibley Group consists of conglomerate, sandstone, shale, carbonates and chert. Keweenawan rocks are represented by diabase dikes and sills, and mafic to felsic volcanic and sedimentary rocks (Osler Group) in the Nipigon Bay–Schreiber Channel area. Late Precambrian intrusive rocks include alkalic and carbonatite complexes such as the Coldwell and Killala alkalic complexes and the Prairie Lake Carbonatite, as well as mafic to felsic dikes.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Schreiber–Hemlo Resident Geologist's Office is staffed by B.R. Schnieders, Resident Geologist, and M.C. Smyk, Staff Geologist, and operates from the Mines and Minerals Division office in Thunder Bay.

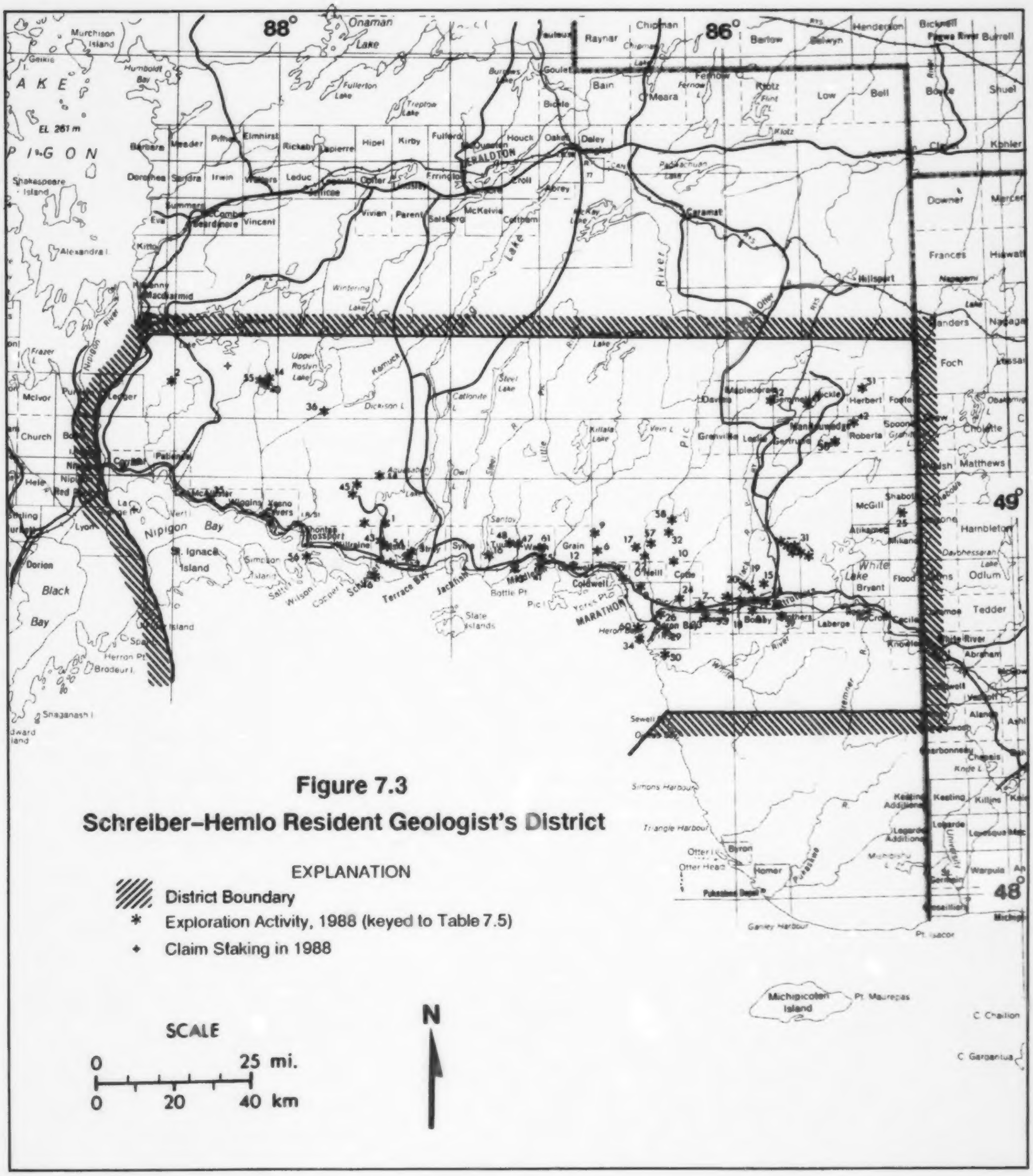

Figure 7.3
Schreiber–Hemlo Resident Geologist's District

88°
86°
49°
48°
Onaman Lake
Murchison Island
Humboldt Bay
LAKE NIPIGON
EL 261 m
Shakespeare Island
Alexandra I.
Nipigon River
GERALDTON
Beardmore
Caramat
Hillsport
Long Lake
Wintering Lake
Upper Roslyn Lake
Kamuck
Dickison L.
Catlonite L.
Steel Lake
Killala Lake
Pic River
Manitouwadge
White Lake
Nipigon Bay
St. Ignace Island
Simpson Island
Black Bay
Dorion
Rossport
Schreiber
Terrace Bay
Jackfish
Bottle Pt.
Pic I.
Slate Islands
MARATHON
Heron Bay
White River
Dog
Simons Harbour
Triangle Harbour
Otter Head
Pukaskwa Depot
Michipicoten Island
Pt. Maurepas
C. Chaillon
C. Gargantua
Pt. Isacor
Gansey Harbour
Raynar
Chipman
Barlow
Selwyn
Henderson
Bicknell
Burrell
Bain
O'Meara
Klotz
Low
Bell
Boyce
Shuel
Kohler
Downer
Mercer
Frances
Foch
Matthews
Hambleton
Odlum
Tedder
Abraham
Daley
Oakes
Houck
Kirby
Hipel
Lapierre
Rickaby
Elmhirst
Meader
Barbara
Dorothea
Sandra
Irwin
Walters
Leduc
Vincent
Vivien
Parent
Salsberg
McKelvie
Cotton
Errington
Croll
Abrey
Mcivor
Church
Ledger
Lyon
O'Neill
Coldwell
Grain
Bryant
Flood
Laberge
McGill
Shabotik
Herbert
Roberta
Spooner
Gertrude
Leslie
Grenville
Davies
Mapledoram
Keating
Killins
Lecarde
Warpula
Michipicoten
EXPLANATION
District Boundary
* Exploration Activity, 1988 (keyed to Table 7.5)
• Claim Staking in 1988
SCALE
0 25 mi.
0 20 40 km
N

TABLE 7.3. SCHREIBER-HEMLO RESIDENT GEOLOGIST'S DISTRICT-EXPLORATION ACTIVITY.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground Work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very Low Frequency

COMPANY/INDIVIDUAL(S) EXPLORATION	PROPERTY NAME	TOWNSHIP/AREA	WORK DONE
1. Ansell Lake Resources Ltd.	Ansell Lake Property	Priske Twp.	linecutting, Mag, VLF, IP surveys
2. Armeno Resources Inc.	M.N.W. Property	Hanson Lake Area	trenching, stripping
3. Beardmore Resources Ltd.	Gold Range Property	Priske Twp.	DDH, geology, sampling
4. Beardmore Resources Ltd.	Hays Lake Property	Priske Twp.	DDH, geology, sampling
5. Belmoral Mines Ltd.	Michano Claims	Walsh Twp.	IP, VLF, Mag surveys, stripping, trenching, sampling
6. Bond Gold Canada Inc. (formerly St. Joe Canada Inc.)	Geordie Lake Property (Macrae Occurrence)	McCoy, Grain, O'Neill Twp., Seeley Lake Area	EM, Mag, VLF surveys
7. Bond Gold Canada Inc. (formerly St. Joe Canada Inc.)	Hemlo West Property	Lecours Twp.	geology, EM, Mag surveys
8. BP Canada Inc. (Selco Division)	McChristie Option	Pic Twp.	VLF, Mag surveys
9. BP Canada Inc. (Selco Division)	Wullie Lake Property	Seeley Lake, Martinet Lake Areas, Grain Twp.	VLF, Mag surveys, geology
10. Carlson Mines Ltd.-Black Gregor Exploration Ltd.-Nexus Resource Corporation	Wire Lake Property	Lorna Lake Area	DDH, stripping, trenching, geochemistry, EM, AMag, VLF surveys
11. Cold Spring Granite (Canada) Limited	Angler Property	McCoy and Pic Twp.	test block removal (quarry)
12. Cold Spring Granite (Canada) Limited	Coldwell Property	Coldwell Twp.	test block removal (quarry)
13. Colossus Resource Equities Inc.	Prairie River Property	Tuuri & Walsh Twp.	DDH
14. Dampier, Gerard		Kabamichigama Lake Area	stripping, sampling
15. Dolphin Explorations Ltd.	Black River Property	Wabikoba Lake Area	soil geochemistry, geology, prospecting
16. Duquette, Lou	Santoy Property	Tuuri Twp.	stripping, sampling, trenching

TABLE 7.3. CONTINUED.

COMPANY/INDIVIDUAL(S) EXPLORATION	PROPERTY NAME	TOWNSHIP/AREA	WORK DONE
17. Duration Mines Ltd.	Midas Option	Seeley Lake Area	prospecting, sampling
18. Esso Minerals Canada	Bel-Air Property	Bomby & Lecours Twp.	linecutting, geological mapping, geophysical surveys (Mag), soil geochemistry, stripping, sampling
19. Esso Minerals Canada	Caulfield Property	Wabikoba Lake Area	linecutting, geological mapping, sampling, geophysical survey (Mag)
20. Esso Minerals Canada	Dakota Property	Wabikoba Lake Area	linecutting, geological mapping, geophysical survey (Mag), sampling, soil geochemical survey
21. Esso Minerals Canada	Harlin Property	Bomby Twp.	linecutting, geophysics (Map, IP), geological mapping, soil geochemical surveys
22. Euralba Mining Ltd., Fleck Resources Ltd.	Marathon Deposit	Seeley Lake Area	feasibility study, geostatistical analysis
23. Fournier, Elwood	Cavers Property	Yesno Twp.	prospecting, stripping, trenching, sampling
24. Fourstar Petroleum Resources Ltd.	Swede Creek Property	Pic Twp.	soil geochemistry
25. Gionet, Reg	Shabotik Property	Shabotik River Area	trenching, sampling, prospecting
26. Golden Range Resources Inc.	Heron Bay Property	Pic Twp.	AEM, AMag
27. Halonen, Lauri	Cavers Amethyst Property	Yesno Twp.	stripping, trenching, mining
28. Hemlo Gold Mines Inc.	International Interlake Property	Bomby Twp., Wabikoba Lake Area	DDH
29. Hemlo Gold Mines Inc.	Heron Bay South Property	Pic Twp.	reconnaissance geology, soil geochemistry, IP
30. Hemlo Gold Mines Inc.	Maple Leaf Property	Mussy Lake Area	AEM

TABLE 7.3. CONTINUED.

COMPANY/INDIVIDUAL(S) EXPLORATION	PROPERTY NAME	TOWNSHIP/AREA	WORK DONE
31. Hemlo Gold Mines Inc.	North Limb Properties	Wabikoba Lake Area	geology, soil geochemistry, trenching, linecutting
32. Hemlo Gold Mines Inc.	Page Lake Property	Seeley Lake & Lorna Lake Areas	Mag, VLF, soil geochemistry
33. Hemlo Gold Mines Inc.	Pringle Property	Lecours Twp.	reconnaissance geology, soil geochemistry
34. Hemlo Gold Mines Inc.	Prospect Cove Property	Pic Twp.	IP
35. Henderson, Mel	Cypress River Property	McAllister Twp.	sampling, prospecting
36. Hibbart, Nick	Greenhedge Lake Property	Dickison Lake Area	prospecting
37. Joa, Melvin	Hays Lake Property	Priske Twp.	prospecting, stripping, sampling
38. Lac Minerals Ltd.	C-Zone Page-Williams Mine	Bomby Twp.	stripping, DDH, open pit preparation
39. Lac Minerals Ltd.	White River Prospect	Brothers, Laberge Twp.	linecutting, geophysical surveys, geological mapping, diamond drilling
40. Laporte, Eldon		Kabamichigama Lake Area	prospecting, stripping
41. McCabe, Roland	Dead Horse Creek (South) Property	Walsh Twp.	sampling, continuing exploration
42. Michon, Robert		Roberta Twp.	prospecting, trenching, sampling
43. Mikkonen, Raimo	Johnston-McKenna Property	Priske Twp.	linecutting, prospecting
44. Minnova Inc.	Big Duck Lake Property	Pays Plat Lake Area	linecutting, (DDH proposed for 1989)
45. Minnova Inc.	Winston Lake (Winston Lake Project) (Zenmac Option) (Gesic Option)	Pays Plat Lake Area	10 000 m DDH, detailed geological mapping, lithogeochem sampling, geophysical survey (IP), downhole pulse EM, CSAMT-resistivity survey, VTEM survey
46. Noranda Exploration Company Ltd.	Hays Lake (Worthington Bay)	Priske Twp.	reconnaissance sampling, staking

TABLE 7.3. CONTINUED.

COMPANY/INDIVIDUAL(S) EXPLORATION	PROPERTY NAME	TOWNSHIP/AREA	WORK DONE
47. Noranda Exploration Company Ltd., Cumberland Resources Limited	Marlhill Property	Tuuri & Walsh Twp.	geological mapping, soil geochemical survey, lithogeochem survey, geophysics (VTEM), DDH proposed
48. Noranda Exploration Company Ltd., Cumberland Resources Limited	Prairie River Property	Walsh & Tuuri Twp.	airborne geophysics (Mag, EM), lithogeochem sampling
49. Noranda Inc. (Geco Division)	Area 80-1C Eastern Extension	Gemmell & Nickle Twp.	reconnaissance mapping, lithogeochem sampling
50. Noranda Inc. (Geco Division)	Faries Lake	Cecil Twp.	reconnaissance mapping, lithogeochem sampling
51. Noranda Inc. (Geco Division)	Hucamp Option & Eastern Extension Claim Group	Gemmell, Herbert & Nickle Twp.	DDH (32 284 feet in 19 holes)
52. Noranda Inc. (Geco Division), Noranda Exploration Company Ltd.	Manitouwadge	Mapledoram, Gemmell & Davies Twp.	reconnaissance mapping, lithogeochem sampling
53. Noront Resources Ltd.	Rous Lake Property	Lecours Twp.	VLF, Mag surveys
54. Otto, Russell	McKenna-McCann (North) Property	Priske Twp.	prospecting, DDH
55. Peterson, Richard		Kabamichigama Lake Area	stripping, prospecting
56. Seeber, Walter	Quarry Island Property	Lahontan Twp.	surveying
57. Seeley Lake Resources Inc.	Pic River Property	Seeley Lake Area	DDH, assays
58. Skalesky, Paul	Goodchild Lake Property	Cirrus Lake Area	EM, VLF, AMag surveys
59. Stenlund, Donald	Stenlund Amethyst Property	Corrigal Twp.	stripping, sampling
60. Teck Corporation	Heron Bay Property	Pic Twp.	underwater IP survey
61. Unocal Canada Limited	Dead Horse Creek Property	Walsh Twp.	sampling, assaying

A field office was maintained at the office of the Northern Development Officer (NDO), Ministry of Northern Development and Mines, in Marathon from May through November 1988.

P. Perry, Resource Geologist, prepared GDIFs, and provided assessment file supervision and office organization until April 1988. M.S. O'Brien assumed duties of GDIF preparation and office organization in May 1988. The completed, published and unpublished, GDIFs are displayed in Figure 7.4. S. Koski maintained and supervised the assessment files and assisted in GDIF updating and office organization.

C. Mack and D. Chiasson provided clerical assistance and support in Thunder Bay and Marathon, respectively.

During 1988, the Schreiber–Hemlo Program dealt with over 900 enquiries from the mining sector and the general public. Visits to 47 properties (*see* Table 7.4, Figure 7.1) were conducted, including four underground and three surface mine tours. In addition, four oral presentations, five poster displays and eight field trips were conducted. Prospectors' courses, which involved 18 hours of classes, were given in Manitouwadge and Terrace Bay, attracting over 40 participants at each location. Staff attended six seminars and conferences, and also participated in local Canadian Institute of Mining and Metallurgy (CIM) and Northwestern Ontario Prospectors' Association functions.

The 1988 Northwestern Ontario Geoscience Seminar was organized and hosted in Thunder Bay in February 1988, and was attended by over 300 participants.

PROPERTY EXAMINATIONS—1988

Joa–Walton (Hays Lake) Occurrence

The Joa–Walton Occurrence was discovered by M. Joa and R. Walton in August 1988. It is located near the northeastern shore of Hays Lake, approximately 9 km east of Schreiber. There are several gold occurrences in the vicinity, including the Hays Lake (Jedder), Otisse, Gold Range and Harkness–Hays properties.

The property is underlain by mafic metavolcanic rocks, mainly massive to pillowed flows and tuffs. Oxide- and sulphide-facies banded iron formation and chert are intercalated with the flows and tuffs. Feldspar porphyry and quartz–feldspar porphyry stocks and dikes intrude these rocks. The northern margin of the Terrace Bay batholith lies approximately 500 m (1640 feet) south of the occurrence. The pillowed metavolcanic flows display evidence of tight isoclinal folding, and a well–developed cleavage is present.

Quartz veins up to 25 cm (10 inches) in width are present near the contact between mafic metavolcanic rocks and quartz–feldspar porphyry. The quartz–feldspar porphyry is a good indicator of gold mineralization in the Schreiber area. The veins occupy shear zones that locally occur at the metavolcanic–porphyry contact. However, they may strike obliquely to contacts, into the mafic metavolcanic rocks or porphyry. Three separate vein occurrences (No. 1, 2, 3), with a combined strike length of up to 120 m (400 feet), were investigated. The veins have a "Z" asymmetry and appear to represent *en echelon*, lenticular veins which strike 250° to 280° and dip 60° to 80° north. The veins display a cockscomb or zipper texture, and contain brecciated fragments of the metavolcanic host rocks and up to 15 percent combined pyrite, chalcopyrite, galena, tellurides and visible gold. The host metavolcanic rocks display shearing, silification, carbonization and saussuritization.

Seventeen selected grab and chip samples from three locations were collected and assayed. Selected values are displayed in Table 7.5. In addition, assay values for gold of up to 0.14 ounce gold per ton have been reported in deformed and altered metavolcanic rocks near the vein occurrences (M. Joa, Prospector, Marathon, personal communication, 1988).

Observation Point Occurrence

The Observation Point Occurrence was brought to the attention of Mines and Minerals Division staff by Jon and Audrey Ferguson who prospect in the Jackfish area. Prospecting led to the discovery of an old pit which had been sunk on a quartz vein near the shore of Lake Superior on Observation Point. Research of previous geological reports had led to the conclusion that this site corresponded to the visible gold discovery denoted by Hopkins (1922) on the northern side of Jackfish Bay.

This occurrence had been previously noted by Coleman (1897):

> "Three-fourths of a mile west of the tunnel a small quartz vein is found in the granite. Some years ago, as Mr. McKellar reports, rich gold specimens were obtained from it; but there was not enough quartz to justify mining it."

and further:

> "Here (Jackfish Bay) a large mass of granite and syenite interrupts the Huronian schists, and contains a small vein carrying free gold just where the railway bends westward from the shore of the bay. This was developed slightly some years ago by the Messrs. McKellar, but proved too small and too pockety to be of value."

The report of the Royal Commission, 1890, stated:

> "At Jackfish Bay they have got gold, but one cannot tell without a regular mining test whether it will pay. We sank on one vein twelve feet; it was rich in gold all the way down. We had half a ton of the ore from Jackfish bay put through a mill, and it concentrated as high as $1,000 and $1,200 to the ton. The Jackfish vein is in the syenite..."

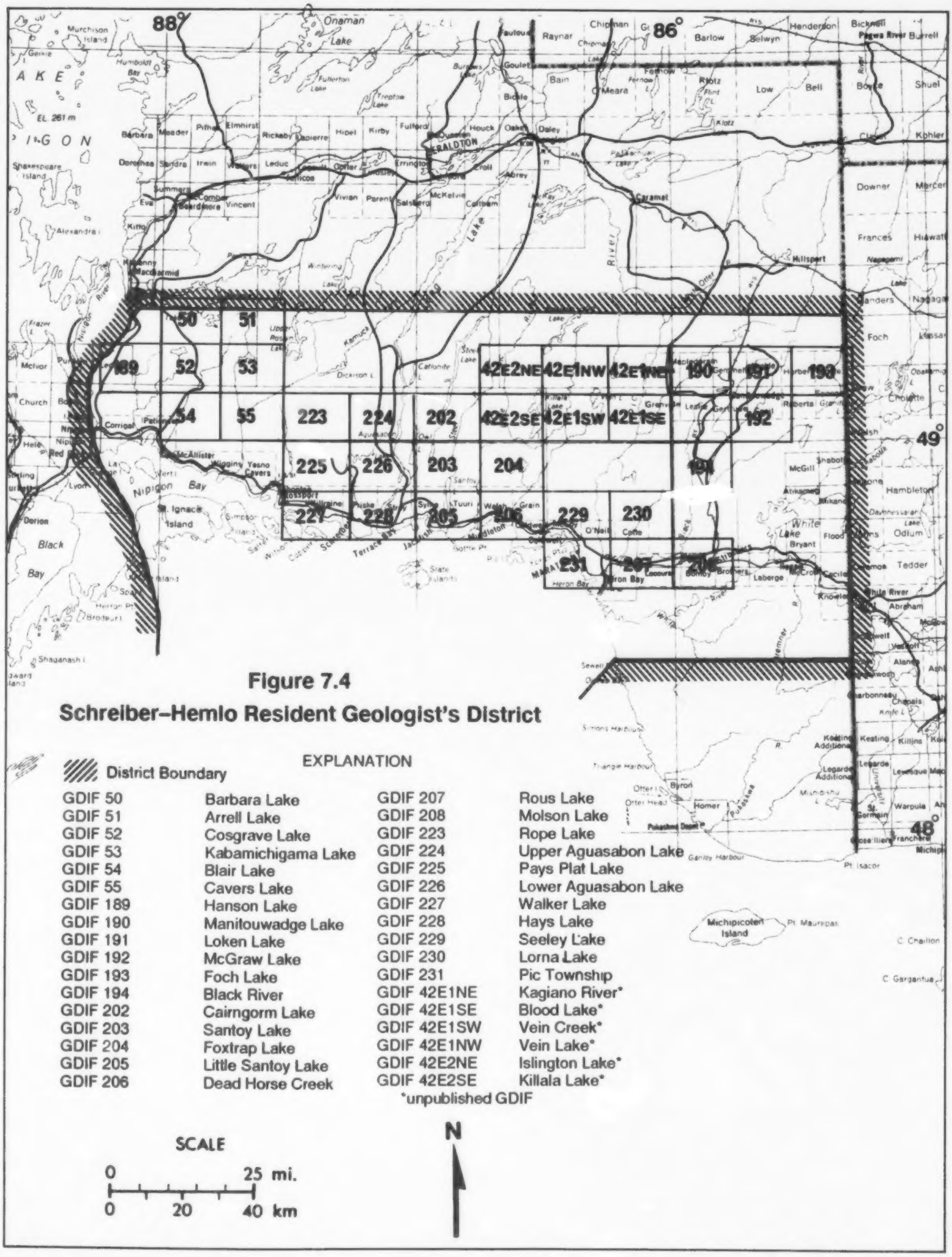
88°
86°
49°
48°
Onaman Lake
GERALDTON
Caramat
Hillsport
Nipigon Bay
Black Bay
Michipicoten Island
50
51
52
53
54
55
189
190
191
192
193
194
202
203
204
205
206
207
208
223
224
225
226
227
228
229
230
231
42E2NE
42E1NW
42E1NE
42E2SE
42E1SW
42E1SE
District Boundary
SCALE
0
25 mi.
0
20
40 km
N

Figure 7.4

Schreiber–Hemlo Resident Geologist's District

EXPLANATION

GDIF 50	Barbara Lake	GDIF 207	Rous Lake
GDIF 51	Arrell Lake	GDIF 208	Molson Lake
GDIF 52	Cosgrave Lake	GDIF 223	Rope Lake
GDIF 53	Kabamichigama Lake	GDIF 224	Upper Aguasabon Lake
GDIF 54	Blair Lake	GDIF 225	Pays Plat Lake
GDIF 55	Cavers Lake	GDIF 226	Lower Aguasabon Lake
GDIF 189	Hanson Lake	GDIF 227	Walker Lake
GDIF 190	Manitouwadge Lake	GDIF 228	Hays Lake
GDIF 191	Loken Lake	GDIF 229	Seeley Lake
GDIF 192	McGraw Lake	GDIF 230	Lorna Lake
GDIF 193	Foch Lake	GDIF 231	Pic Township
GDIF 194	Black River	GDIF 42E1NE	Kagiano River*
GDIF 202	Cairngorm Lake	GDIF 42E1SE	Blood Lake*
GDIF 203	Santoy Lake	GDIF 42E1SW	Vein Creek*
GDIF 204	Foxtrap Lake	GDIF 42E1NW	Vein Lake*
GDIF 205	Little Santoy Lake	GDIF 42E2NE	Islington Lake*
GDIF 206	Dead Horse Creek	GDIF 42E2SE	Killala Lake*

*unpublished GDIF

TABLE 7.4. PROPERTY EXAMINATIONS—1988.

1. Angler
2. Beaver Creek
3. Big Nama
4. Christie
5. Crystal Creek
6. Dead Horse Creek Y-REE Property
7. Duquette (Santoy)
8. Eastern Extension
9. Empress Mine
10. Esso Minerals (Bel Air)
11. Esso Minerals (Harlin)
12. Fakeloo Lake
13. Faries Lake
14. Fleck (Marathon Cu-PGE Property)
15. Gale
16. Geco Division Mine (Noranda Inc.)
17. Glory Holes-Noslo
18. Golden Giant Mine
19. Gold Range
20. Hemlo Highwáy Section
21. Heron Bay (Stenlund)
22. Herrick (Walton)
23. International Maple Leaf
24. Joa-Walton (Hays Lake)
25. Lenora-Argentex
26. Manitou Falls
27. McKenna-McCann (North)
28. Moshkinabi Lake
29. Neys
30. Neys Provincial Park
31. North Shore Mine
32. Observation Point
33. Padre Resources
34. Page-Williams Mine
35. Page-Williams Mine: A-Zone
36. Page-Williams Mine: C-Zone
37. Pic Island
38. Poppy Lake
39. Pukaskwa National Park
40. Rabbitskin Lake
41. Rideau Resources
42. Shabotik (Gionet)
43. Stenlund Amethyst
44. White Lake Prospect
45. Willecho Mine
46. Willroy Mine
47. Winston Lake Division Mine (Minnova Inc.)

(Resident Geologist's Files, Mines and Minerals Division, Ministry of Northern Development and Mines, Thunder Bay)

The Observation Point occurrence lies just below the Canadian Pacific Railway, approximately 15 m from the shore of Lake Superior, at a point 1370 m along the tracks west of the railway tunnel on Jackfish Bay. It occurs in locally quartz-phyric granite and quartz diorite that are the southeastern margin of the Terrace Bay batholith. The contact with the enclosing mafic metavolcanic rocks lies approximately 1.3 km to the east. Lineaments trend east, northwest and northeast, and represent faults and fracture zones commonly occupied by diabase dikes.

The occurrence consists of subparallel quartz vein sets that usually occupy northeast-striking, west-dipping joints in the granite. The veins range in width up to 30 cm (12 inches) and are cut in some places by narrow lamprophyre dikes.

The quartz vein on which the pit has been sunk is exposed in a south-facing pit wall. It is irregular on surface and strikes approximately north-northeast; it dips 25° to 30° west. The vein system consists of a main, bull-white section, 30 cm (12 inches) wide, plus parallel quartz stringers, irregular veins and rusty, fissile fracture zones which occupy a zone over 1 m wide.

The quartz is largely barren of sulphides. Pyrite occurs in patches and narrow bands with molybdenite, parallel to vein margins. The pyrite- and molybdenite-rich portions of the vein returned the best gold values. No visible gold was noted in samples, nor in panning of crushed quartz-vein material.

Sampling returned the following assay results:

Sample Number	Sample Description	Au (oz./ton)	Ag (oz./ton)
88BJF-26	granite with patchy quartz, pyrite <2%	0.02	<0.10
88BJF-29	quartz vein with pyrite and molybdenite seams	0.18	0.48
88BOP-08	quartz vein with pyrite and molybdenite seams	0.10	0.28
88BOP-09	quartz vein with pyrite and molybdenite seams	0.07	0.17

Duquette (Santoy) Occurrences

L. Duquette holds several claims near the southeastern end of Santoy Lake, in Tuuri Township, on which two main occurrences are found. The property is underlain by clastic metasedimentary rocks and granite stocks within a large volcano-sedimentary succession.

The two occurrences have been named the Powerline and Hillside occurrences, respectively.

The Powerline Occurrence occurs between two powerline corridors and extends across the more southerly line. It consists of a series of *en echelon* quartz veins hosted by a medium-grained pink granodiorite and fine-grained metasedimentary

TABLE 7.5. SELECTED ASSAY VALUES FROM THE Joa-Walton OCCURRENCE.

Sample No.	Au (oz./ton)	Ag (oz./ton)	Description
88BJW-01	1.36	2.72	bull white quartz vein, No. 1 vein, gray mineral, galena
88BJW-02	0.02	<0.10	fine grained, quartz-feldspar porphyry, host rock, No. 1 vein, 15 cm chip sample
88BJW-03	0.79	1.23	quartz vein, 6 cm full width sample, No. 1 vein, coarse pyrite
88BJW-05	1.02	1.64	2nd pit, No. 1 vein, selected grab sample
88BJW-07	2.32	4.26	quartz vein, minor py, cpy, 7.5 cm full width, No. 1 location
88BJW-10	0.07	<0.10	quartz vein, 10 cm wide full width, minor cpy, No. 3 location
88BJW-15	5.80	14.16	originally quartz float, small vein discovered, No. 2 vein, visible gold noted
88BJW-17	6.80	8.34	quartz vein, No. 1 location, visible gold noted, galena or telluride

rocks, which outcrop south of the powerline. The quartz veins pinch and swell along a strike direction of 140° to approximately 165°. The veins have dips of 35° to 65° to the southwest and are exposed on a hillside where the talus consists of granite boulders and quartz float.

The main vein has been traced by overburden stripping for almost 90 m (300 feet). It has an average width of 1.5 m and consists almost entirely of massive, bull-white quartz. It has been test-pitted where it is locally mineralized (up to 10 percent) with galena, chalcopyrite and lesser pyrite and pyrrhotite. Sulphides occur in the wall rock or in small, parallel stringers of quartz. The sulphide mineralization is typically erratic, occupying irregular fractures and seams in the quartz vein.

The southern extension of the main vein system consists of irregular quartz stringers and vein breccia, hosted by aplite and dark grey silicified clastic metasedimentary rocks. Two small pits have been blasted in these showings. The contact between the granitic and metasedimentary rocks is not exposed.

The Hillside vein, consisting essentially of white quartz, occurs on the northern side of a hill at the contact between granodioritic to dioritic rocks and magnetite iron formation. The vein is exposed for 2 to 3 m in a west–southwest direction and has an almost vertical dip. Considerable oxidation (gossan) occurs on the south side of the vein where massive magnetite is exposed. The vein is mineralized with pyrite, chalcopyrite and magnetite. Near the contact with the vein, the granite is also mineralized, with pyrite and chalcopyrite. The vein is 1 to 1.3 m wide and the magnetite-rich zone contains chalcopyrite and malachite.

The second exposure occurs about 3 to 4 m down the side of the hill from the first vein. Here a system of quartz veins is hosted by dioritic rocks and pink feldspar–phyric granitic rocks. The veins contain both white and grey quartz, and vary in width from 20 cm to 1.3 m. One vein appears to be almost flat–lying relative to the topography whereas the main vein of the system, which strikes 135° to 140°, appears to be almost vertical or dipping steeply to the south. The flat–lying vein consists mostly of white quartz. A third vein, about 20 to 25 cm wide, appears to be a ladder vein between the flat–lying and vertical vein. The ladder vein and the vertical vein are both mineralized with pyrite, chalcopyrite, galena, and possibly molybdenite, whereas the flat–lying vein appears to be quite barren. Green mica, hematite and limonite stain occur in the vertically dipping vein.

Selected grab samples of the mineralized quartz veins at both occurrences returned assays up to 0.02 ounce gold per ton and 3.25 ounces silver per ton. The magnetite iron formation returned values of up to 0.02 ounce gold per ton, 4220 ppm copper and 700 ppm zinc.

North Shore Mine

The North Shore Mine is located near the shore of Lake Superior on Worthington Bay, approximately 6 km south of Schreiber. The property has been previously described by Patterson *et al.* (1984). The mine produced 2441 ounces of gold and 226 ounces of silver during the years 1923, 1929, 1932–1933, 1935–1937, and 1941. The average gold grade was 0.64 ounce gold per ton.

The property is underlain by felsic metavolcanic rocks and syenite, and lies near the western margin of the Terrace Bay batholith. Lamprophyre, porphyry and diabase dikes are abundant. Shearing is evident and a major north–striking fault extends across the property. Gold occurs in quartz veins striking 100° and dipping 55° south, which are hosted in shear zones within the syenite. The main vein is 2.5 to 35 cm wide and has been traced for 490 m (1600 feet) between two faults.

Development work consisted of two adits, 275 m and 290 m long respectively, a 40 m inclined winze and two working levels. Additionally, three smaller adits and several shafts and pits were also started (Resident Geologist's Files, Mines and Minerals Division, Ministry of Northern Development and Mines, Thunder Bay).

The old workings and local geology were re-examined by staff of the Resident Geologist's Office in 1988. Sampling was undertaken on zones of interest across the property, in addition to the mine site itself. The main quartz veins at the eastern adit strike approximately 100° to 110° and dip 50° south. They are generally 15 to 20 cm in width but may reach 35 cm. The adit has been driven on the more southerly vein. These veins are crosscut by a green mica-rich, rusty, carbonate breccia vein, 10 cm wide. Smaller, narrow, parallel carbonate veins occur in the host and cut a smaller quartz vein. Carbonate and epidote slips are developed in the larger bull-white quartz veins.

A 30 cm wide, crack-seal quartz vein is exposed in the roof of the western adit. The vein, which is hosted by a hematite-stained quartz-feldspar porphyry, contains pyrite, galena and visible gold, with accessory epidote, carbonate, hematite and chlorite.

Assay results from selected grab sampling of the eastern and western adit areas of the North Shore Mine are given in Table 7.6.

Shabotik PGE Occurrence (Gionet)

The Shabotik Occurrence lies in south-central Shabotik Township, approximately 15 km northeast of White Lake. Limited exploration work has been carried out on this occurrence. Trenching and diamond drilling on the occurrence by Two L's. Mining Company Limited was carried out in 1969. D. Carroll completed some trenching and sampling in 1985. It is currently staked by R. Gionet and G. Gionet who have continued trenching and sampling of the main showings. The property was visited in October 1988 by staff of the Schreiber-Hemlo Resident Geologist's Office.

The occurrence is hosted in amphibolite facies rocks of the Abitibi-Wawa subprovince. Rocks in the vicinity are felsic, tonalitic gneisses and metasedimentary migmatites containing mafic to ultramafic xenoliths. Gneissosity or banding trends in a east-northeasterly to easterly direction.

Sulphide mineralization is for the most part confined to a mafic intrusion within the gneissic rocks. Its overall composition corresponds to a monzodiorite or gabbro, although compositional and textural variation is common. Proportions of hornblende and biotite, the main mafic minerals, vary inversely with those of plagioclase and alkali feldspar. Consequently, there are ultramafic as well as felsic portions within the body. A medium-grained, subhedral granular texture gives way locally to hornblende-phyric and pegmatitic sections. Internal and external contact relations are obscured by lack of exposure. The mafic body has been traced for approximately 90 m in a northeast direction by surface trenching and may attain a width of 30 m.

Pyrite, chalcopyrite, pyrrhotite and pentlandite are the main sulphides in the mafic rocks; molybdenite occurs in the gneisses. The sulphides occur either interstitially to the silicates or as replacement minerals. Local sulphide concentrations may exceed 25 percent, but the average is generally 3 percent or less. Magnetite is notably absent. The platinum group minerals (PGM) are presumably associated with the sulphides.

The development of sulphide mineralization may be related to the extensive alteration of the silicate minerals. Hornblende is commonly altered to biotite and chlorite. Plagioclase and alkali feldspar, including microcline, have been sericitized. Epidote is ubiquitous; sphene is a common accessory mineral.

Selected grab sampling results from the Shabotik Occurrence have indicated remarkable base-metal and PGE values (*see* Table 7.7). The platinum:palladium ratio is generally 1:1 or better.

Electron microprobe studies of sulphide-rich samples have been initiated. Froodite ($PdBi_2$),

TABLE 7.6. SELECTED ASSAY VALUES FROM THE NORTH SHORE MINE.

Sample No.	Description	Au (oz./ton)	Ag (oz./ton)
EASTERN ADIT			
88BNO-01	'Northern' Vein crack-seal quartz & rusty carbonate disseminated pyrite	0.09	<0.10
88BNO-03	'Northern' Vein crack-seal to massive quartz & carbonate; rare pyrite	1.54	0.10
88BNO-04	Rusty Carbonate Breccia Vein with quartz vein fragments & pyrite & green mica	1.88	0.14
88BNO-05	1 m chip sample, 8 cm wide 'flat' quartz vein cut by carbonate veinlets & pyrite	0.06	0.10
WESTERN ADIT			
88BNO-06	Crack-seal to massive quartzvein, locally visible gold	1.80	0.27
88BNO-11	Western Adit dump dark grey rhyolite with <1% disseminated pyrite	0.03	<0.10
88BNO-16	Western Adit dump crack-seal quartz vein pyrite & tellurides(?) & visible gold	40.40	1.28

TABLE 7.7. SELECTED ASSAY VALUES FROM THE SHABOTIK PGE OCCURRENCE.

Sample No.	Sample Description	Pt (ppb)	Pd (ppb)	Cu (ppm)	Ni (ppm)	Au (ppb)	Ag (oz./ton)
84BRG-01	diorite; semi-massive py, cp	3050	680	2.38%	n/a	40	0.98
84BRG-03	diorite; semi-massive py, cp	760	400	2.66%	n/a	40	0.91
88BSH-8	mafic, hbl-rich; 5-10% sulphides	1100	550	4700	4480	18	
88BSH-7	coarse-grained diorite; 30-40% sulphides	270	450	1.55%	3960	40	n/a
88BSH-9	medium-grained diorite; <30% sulphides	270	700	3830	1.00%	24	n/a
88BSH-16	amphibole pegmatite; 20% sulphides, py>>cp	2825	1125	6350	2400	16	n/a

n/a *not assayed*

kotulskite (Pd(Te,Bi)) and lead–selenium–arsenic–antimony minerals have been tentatively identified (D. Kingston, University of Western Ontario, London, personal communication, 1988). PGM grain size ranges up to approximately 20 µm.

RESEARCH BY RESIDENT OFFICE STAFF

Several research projects have been undertaken in 1988 by the Schreiber–Hemlo Resident Geologist's staff, some of which will be continued or completed in 1989. These projects are designed to address specific areas of geological interest to the exploration and mining sectors.

Jackfish Mapping Project

Cursory mapping and investigations of mineral occurrences were undertaken in the Noslo (Canoe) Lake area, in Syine Township. Efforts were made to identify and relocate old showings, some of which date back to the late 1800s. The location of these occurrences with respect to major lithologic and structural features was also studied.

The majority of these occurrences belong to the Terrace Bay batholith–Contact Zone–type of gold mineralization (Patterson *et al.* 1987). Local examples include the Empress Mine (past producer) and the Beaver Creek occurrences which have undergone active exploration in the past few years. The map area, which contains 14 gold occurrences (>0.1 ounce gold per ton), will be expanded in 1989 to encompass the whole of the eastern contact of the batholith, to Jackfish and Cape Victoria. The emphasis will be to relocate and document old occurrences and substantiate, if possible, historical reports of these showings (e.g., Observation Point in this report).

Hemlo Barite Occurrences

The occurrence of barite in the Archean stratigraphy and in the orebodies at Hemlo will be studied to better understand its nature, setting, origin and role in gold mineralization. Detailed mapping and sampling have been initiated on barite occurrences west of Hemlo (e.g., Padre Resources Property) for petrographic and geochemical study. Other occurrences will be examined in 1989 in hopes of using baritic horizons in mapping, stratigraphic correlation and gold exploration.

Hemlo Orebody Study

Detailed sampling and mapping of the Page–Williams Mine A–Zone open pit orebody, and of the adjacent footwall and hanging wall rocks, have been initiated. Petrographic and geochemical study of these rocks will be undertaken to better understand mineralogical and geochemical alteration and zonation with respect to the mineralized zone.

Rare Earth Element Study

Following extensive overburden stripping operations conducted by Unocal Canada Limited on the Dead Horse Creek yttrium and REE property, detailed sampling of variably mineralized lithologic units was conducted. Microscopic and electron microprobe examination of mineralized samples will be undertaken in order to identify ore minerals and better document alteration assemblages for exploration purposes.

In conjunction with the Industrial Minerals Program, Northwestern Region, uranium–niobium–rare earth element occurrences, discovered in the Coldwell Alkalic Complex in the 1950s, will be visited and documented.

HISTORICAL RESEARCH

Historical research of old newspapers by K.G. Fenwick led to the discovery of some of the earliest reports of gold in the Hemlo area. The Fort William Daily Times–Journal reported:

> "J.R. Lecours, a telegraph operator of Hemlo, 200 miles east of Port Arthur, came into Port Arthur today with a number of samples of gold-bearing ore, accompanying assay sheets showing returns running from eight dollars to sixty-four dollars per ton (0.39 to 3.10 ounces gold per ton).
>
> Lecours states that for the past five years he has been using his spare time in an endeavor to trace the extent of the veins from which samples were taken for assaying and tells that he has followed it for a thousand feet and now has recorded four claims.
>
> Keeping the matter quiet, he and a couple of other railwaymen are all who have taken up claims in the section. Test pits, he states, have shown a widening of a four foot vein as depth increased."
>
> (July 12, 1927)

Later reports followed:

> "Assaying, according to reports from the government analyst at Toronto, from $4.60 to $86 a ton (0.22 to 4.16 ounces gold per ton) a rich gold find has been made at Hemlo, 200 miles east of Fort William on the Canadian Pacific railway.
>
> Jos. LeCoeur, the station agent, made the discovery of gold in the vicinity some time ago, but kept his find quiet until he had made a thorough investigation and satisfied himself that the find was genuine. He himself staked out five claims, in which were found four veins of gold-bearing quartz, from four feet to thirty-five feet in width...
>
> W. Longworth and Charles Greer, of Port Arthur, took up seven claims there a few days ago, in which five veins have been found. Walter Ballard and J. Sheehan of Schreiber, have found some more veins east of Hemlo, which have assayed very highly.
>
> The Manion–McAvay interests, of Fort William, have eight claims there. The formation shows intrusions of porphyry, with chlorite schist, and is near the granite contact with some conglomerate dykes. The veins are large and well mineralized.
>
> Engineer McRae of the Dome Mine, Cobalt, will visit the property in a few days, and make a report."
>
> (July 25, 1927)

RECOMMENDATIONS FOR EXPLORATION

GOLD

The metavolcanic and metasedimentary rocks which wrap around the Heron Bay, Gowan Lake and Cedar Lake plutons are considered to have excellent potential for gold. Metavolcanic–metasedimentary contacts, deformation zones and porphyry contacts, together with the the presence of sericite schists, disseminated pyrite, molybdenite, green mica, barite and pervasive potassic alteration (microcline and muscovite–sericite), are considered to be important in characterizing gold mineralization in the Hemlo area.

Recent developments and exploration in the Hemlo camp have indicated parallel mineralized zones within both the footwall and hanging wall rocks. Further exploration, including stripping, trenching and sampling, is warranted along the barite–green mica–sericite–pyrite horizon to the west of the Hemlo mines. This area includes the Northern Eagle, Padre, Kadrey, Rideau Resources and Cal–Dynamics properties.

In the Heron Bay area, the porphyritic felsic stocks and extrusive rocks, deformed pillowed metavolcanic rocks and lithological contacts are viable exploration targets for gold. Lithologic contacts appear to represent zones which focus deformation, an important parameter in localizing gold mineralization.

Recent exploration results by Carlson Mines Ltd.–Black Gregor Explorations Ltd. in the Wire Lake area, and prospecting by local prospectors, suggest that the Cirrus Lake–Goodchild Lake–Veronica Lake area (Milne 1967) requires further exploration. During 1988, several high-grade molybdenite-bearing quartz veins containing low gold values (0.01 to 0.03 ounce gold per ton) were discovered by R. Renner in the Pic River area.

Re-analysis of lake bottom sediment samples from a 1970s survey by the Geological Survey of Canada was performed as part of an orientation study to evaluate lake sediments for precious metals content. Samples from three lakes to the east and south of Goodchild Lake, namely Fallen Lake, Budall Lake, and a small lake approximately 1.6 km (1 mile) east of Budall Lake, indicate anomalous gold values. An association of gold, chromium and nickel, and to a lesser extent zinc, silver and cadmium is apparent (P. Friske, Exploration Geochemistry Subdivision, Geological Survey of Canada, Ottawa, personal communication, 1987). Felsic intrusive rocks in the Veronica Lake area and southwest of Goodchild Lake are recommended targets.

The northwest contact aureole at the Terrace Bay Batholith is considered an excellent gold exploration target. The exploration model presented in Patterson *et al.* (1987) suggests one possible approach to this area. Felsic intrusive rocks, including porphyry and aplite dikes, are abundant adjacent to the Terrace Bay Batholith and display potassic alteration with elevated gold levels. Preliminary sampling of an aplite dike on the Hays Lake Property indicated 0.05 ounce gold per ton. Exploration models presented in Patterson *et al.* (1987), combined with their recommendations to prospectors, helped in the discovery of a new gold occurrence by Melvin Joa and Ron Walton. Further prospecting and exploration are recommended in the North Shore–Harkness Hays–Gold Range–Hays Lake area due to the abundance of high-grade gold-bearing quartz veins there.

Exploration programs on narrow, high-grade, structurally controlled veins, such as the Johnston–McKenna, McKenna–McCann and Schreiber Pyramid properties, should make use of the prospectors' tool of the 1980s, the backhoe, and include two-dimensional stripping and trenching. Small-scale mining operations could consider optical sorting methods for these vein types.

The Big Duck Porphyry and its contacts with the surrounding metavolcanic rocks have a high potential with more than 20 known gold occurrences present in a 6 km by 3 km area. Structural controls combined with potassic alteration are suggested as indicators of gold mineralization.

Previous prospecting and exploration in the Barbara Lake–Glacier Creek area have indicated a large-scale north–northeast-trending fault system (Jackpine River–Glacier Creek Fault) with scattered copper occurrences along a 20 km (12 mile) strike length. Previous diamond drilling has indicated widths of over 30 m assaying 0.5 percent copper. Recent prospecting and sampling have indicated gold values up to 0.14 ounce gold per ton. Further prospecting and exploration are recommended in the Glacier Creek–Kabamichigama Lake area along these large-scale fault systems.

BASE METALS

Winston Lake Area

Calc–alkalic intermediate to felsic metavolcanics in this area are considered to have a high exploration potential for base metals. The metavolcanics consist of pyroclastic flows, debris flows and laminated ash deposits. Intense hydrothermal alteration of these and associated calc–alkalic metavolcanic rocks has been responsible for the misidentification of such indicator rocks. In addition, the nature of the sheet-like boudinaged deposits in the Winston Lake area, and of the rafted and dislocated mineralized zones at the Zenith Deposit, are a testament to the complex structural deformation in this area, and to the importance of understanding it.

Lithogeochemical surveys to detect sodium and calcium depletion, and magnesium, potassium, zinc and copper enrichment, are considered valuable exploration tools for identifying hydrothermal alteration zones associated with massive sulphide-type base-metal deposits.

Lyne Lake–Victoria Lake Area

The authors consider the Lyne Lake–Victoria Lake metavolcanic–metasedimentary rocks to represent an extension of the Winston Lake stratigraphy which has been separated by granitic intrusions. Calc–alkalic, felsic to intermediate, fragmental metavolcanic rocks are considered excellent exploration targets, as are areas of hydrothermal alteration characterized by the presence of cordierite, anthophyllite, sillimanite and garnet.

Santoy Lake–McKellar Lake Area

This area is underlain by a large felsic metavolcanic unit which trends west–northwest and hosts numerous base-metal occurrences including the Marlhill, Goldbar Lake, Bozena (Bonne), Prairie West, Alvey and Granite Mountain properties. Felsic pyroclastic flows and tuffs were observed in the Granite Mountain area where clast-supported flows contained considerable garnet in the matrix. Copper, zinc and magnesium enrichment, combined with sodium depletion, were noted in deformed metavolcanic rocks in the Marlhill area. Felsic metavolcanic rocks in the Fishnet Lake area have been mapped as "andalusite-bearing tuffs" by Walker (1967) and may represent hydrothermally altered rocks. Iron formation and related chemical and clastic metasedimentary rocks commonly contain anomalous zinc, lead, copper, silver and gold concentrations and should be explored.

Pic River Area (Page Lake–O'Neill Township)

The economic potential for gold and base metals is considered high in the felsic metavolcanic rocks of the area, and at contacts of these rocks with the mafic metavolcanic and granitic rocks in the Page Lake area. Patterson (1984) described the Knut Kuhner occurrence:

> "The geology of the property was mapped by Milne (1967). It is underlain by felsic pyroclastic rocks on the west and mafic metavolcanics on the east. Metasediments, graphitic schists, pelites, cherts, and massive sulphides occur between the felsic and mafic metavolcanics. A lake bottom sediment geochemistry sampling program (Geological Survey of Canada, Open File Report 746) shows a large copper, lead, zinc and mercury anomaly, similar to the anomaly at Manitouwadge, centred on Page Lake.
>
> In 1983, drill logs with complete assays, from an exploration program by Kerr Addison Mines Limited in 1971, were added to the Resident Geologist's Files; Ontario Ministry of Natural Resources, Thunder Bay. The best results were for drillhole KP-71-5 which intersected 18.2 feet of 0.08 ounce gold per ton and 1.16 percent zinc.
>
> The mineralization encountered occurs as pyrrhotite, sphalerite, and pyrite hosted in felsic metavolcanics.

Airborne geophysics done by Shell Canada Resources Limited in 1977 shows a number of EM conductors (Resident Geologist's Files; Ontario Ministry of Natural Resources, Thunder Bay)."

Manitouwadge Area

The limbs of the Manitouwadge Syncline and the extensions of the Manitouwadge stratigraphy into Gemmell, Nickle and Herbert townships, as well as to the north of those townships, are considered high potential areas for base metals. Preliminary reconnaissance during 1988 identified numerous areas of metasedimentary and metavolcanic gneisses, or "ghost greenstone", previously denoted as granitic rocks on the compilation map of the Manitouwadge area. The metavolcanic–metasedimentary limbs have been extremely disrupted and intensely deformed, and subjected to amphibolite grade metamorphism and hydrothermal alteration. Consequently, these rocks can be difficult to identify as exploration targets.

In addition, the mineralized showings are generally considered "dry" looking and are not very spectacular. However, caution and a fair amount of patience must be taken when assessing showings in amphibolite facies terrains, as the discovery of Manitouwadge and Hemlo mining camps has proven.

The presence of sillimanite, cordierite, garnet and anthophyllite is indicative of hydrothermal alteration and (or) high-grade metamorphism. Most known ore deposits are hosted by muscovite–quartz schist. Kyanite mineralization was discovered on the north limb of the Manitouwadge Synform near Rabbitskin Lake in 1988 and appears to represent hydrothermally altered metavolcanic rocks.

In the Hemlo area, the gold deposits are also hosted by sericite–muscovite–pyrite schists in amphibolite facies rocks. Therefore, an area such as Manitouwadge which is recognized solely for base metals should be re-investigated for possible gold potential as well.

PLATINUM GROUP ELEMENTS

Exploration for PGE mineralization in the Schreiber–Hemlo area could be concentrated in six major areas: 1) the Coldwell Alkalic Complex; 2) the Killala Lake Alkalic Complex; 3) the Goodchild Lake area; 4) the Rhea Lake–Hornblende Lake area; 5) the Jackfish area; and 6) the Shabotik Township area.

Prospecting and exploration for PGE in the Schreiber–Hemlo District should concentrate on the following parameters or characteristics:

1. mafic to ultramafic (dark coloured) intrusive rocks of Proterozoic to Archean age
2. disseminated sulphide mineralization within the mafic to ultramafic intrusive rocks—generally less than five percent is sufficient—(copper–rich sulphide concentrations are enriched in PGE in several areas within the Coldwell Alkalic Complex and elsewhere)
3. mafic or ultramafic rocks, which display variations in grain size (i.e., fine–grained to pegmatitic), modal layering, disrupted layering, intermixing of magma types, magmatic–related breccias, and pegmatitic dikes or veins

Any areas which exhibit the above characteristics, especially those of (3.), should be thoroughly prospected and sampled for PGE.

The Coldwell and Killala Lake Alkalic complexes are currently being explored for PGE. Cursory studies of copper sulphide–type PGE mineralization have cited characteristic parameters that may aid exploration. Copper– and PGE–rich sulphide concentrations locally occur in gabbroic rocks (Patterson *et al.* 1987; Coates 1970). The gabbroic rocks commonly display evidence of magma mixing, alteration, and multiple intrusive events. Sulphides, occurring in breccias, dikes, pegmatites, veins and altered portions of the gabbro, should be sampled and assayed for PGE. The rocks in the Goodchild Lake, Rhea Lake–Hornblende Lake and Jackfish areas are Archean metavolcanics and mafic to ultramafic intrusive rocks with which copper–nickel sulphides are associated. It is suggested that PGE mineralization may be associated with these copper–nickel sulphides.

In the Goodchild Lake area, sulphides occur in an altered metavolcanic body (Milne 1967). The Nicopor Mines copper–nickel occurrence is situated in amphibolitized metavolcanic rocks and gabbros, along a contact with a granite, in the Rhea Lake area (Bartley 1939). Gabbro, diorite, hornblendite and derived amphibolite occur within a metavolcanic belt in the Jackfish area (Walker 1967). References have been made to a platinum discovery made near the turn of the century by a Captain Pritchard (Schnieders *et al.* 1988).

With the recent discovery of PGE in the Shabotik Township area, further prospecting and exploration is warranted in this region. The Kwinkwaga Lake Map 2179G (Airborne Magnetic Survey) displays high magnetic anomalies in the southeastern and northwestern corners of Shabotik Township as well as central Mikano Township, northern Flood Township, northeastern Bryant and central Hambleton townships, which should be investigated. The high magnetic anomalies normally indicate the presence of mafic rocks, such as diabase, gabbro or serpentinite, which have a relatively high iron content and in special instances, may be due to concentrations of magnetic minerals such as pyrrhotite and magnetite.

RARE EARTH ELEMENTS

Exploration for rare earth elements should concentrate on 1) syenitic dikes, and 2) diatreme structures, in and around the Coldwell Alkalic Complex. Potential targets are invariably radioactive and are most easily discerned using a portable scintillometer or Geiger counter. Pervasive hematization and silification are associated with diatreme–hosted mineralization. Calcite and epidote are common accessory minerals.

INDUSTRIAL MINERALS

Exploration for industrial minerals appears to be on an upswing. High quality amethyst is available on an, as yet, undeveloped property on Nagunagisic Lake just north of Wiggins Township. Exploration for building stone has concentrated on syenites in the Coldwell Alkalic Complex ('black' and 'red granite') and on buff to red sandstone on the offshore islands in Lake Superior, between Nipigon and Rossport. Lithium– and beryllium–bearing pegmatites are present in the Georgia and Barbara lakes area. A more complete treatment of Industrial Minerals and Rare Earth Elements in the Schreiber–Hemlo District is available in Kennedy and Sherlock (this volume).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

A. T.L. Muir continued a tectono–stratigraphic study of the Hemlo area.

B. H.R. Williams continued his study on the tectonic evolution of the Beardmore–Geraldton area with emphasis on the boundary between the Wabigoon and Quetico subprovinces as well as the tectonic development of the rocks at the Wawa–Quetico subprovince boundary. In addition, Williams did reconnaissance investigations of gneissic and granitic terrains in the Manitouwadge area.

The locations of these studies is shown on Figure 7.1.

RESEARCH BY OTHER AGENCIES

P. Friske, Geological Survey of Canada, is conducting a lake bottom sediment geochemical survey in and around the Coldwell Alkalic Complex.

T. Barrett (IREM–MERI, McGill University), P. Fralick (Lakehead University) and I. Jarvis (Kingston Polytechnical Institute, UK) are conducting rare earth and trace element analyses on barite horizons and associated rocks from the Hemlo area.

T. Barrett (IREM–MERI, McGill University), P. Fralick (Lakehead University) and B.R. Schnieders (Mines and Minerals Division, Ministry of Northern Development and Mines, Thunder Bay) are studying morphology and geochemistry of colloform structures in sulphide–facies iron formation on the Morley Property, Schreiber.

P. Fralick (Lakehead University) and H. Strauss (University of California at Los Angeles, USA) are investigating sulphur and carbon isotope values from the Winston Lake massive sulphide deposit, and from sulphide–facies iron formation in the Schreiber–Terrace Bay area.

R.H. Mitchell and R.G. Platt (Lakehead University) are continuing research into the petrology of the Coldwell Alkalic Complex.

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

Y. Pan (MSc candidate, University of Western Ontario, London) in conjunction with M.E. Fleet (Professor, University of Western Ontario, London) is continuing a metamorphic petrology study of the White River gold prospect.

S.A. Kissin (Lakehead University), E.A. Jennings (Noranda Exploration Company, Limited), R.L. Sherlock (Lakehead University) and T.C. McCuaig (University of Saskatchewan) are studying the genesis of silver vein deposits in the Thunder Bay area.

UNIVERSITY THESES

S. Osterberg (PhD candidate, University of Minnesota–Duluth) is conducting a stratigraphic–alteration study of the Winston Lake stratigraphy, Schreiber, Ontario.

D. Laderoute (MSc, Lakehead University, Thunder Bay, Ontario) completed a petrologic and geochemical study of dike rocks in the Coldwell Alkalic Complex.

J. Lukosius–Sanders (MSc, Lakehead University, Thunder Bay, Ontario) completed a petrologic study of quartz syenites of Center 3, Coldwell Alkalic Complex.

D. Nicol (MSc candidate, Lakehead University, Thunder Bay, Ontario) is conducting a study on assimilation in Center 3 syenites of the Coldwell Alkalic Complex.

T. Mulja (MSc candidate, Lakehead University, Thunder Bay, Ontario) is conducting a study on the petrology and platinum group element mineralization of the Geordie Lake Gabbro, Coldwell Alkalic Complex.

R. McLouglin (MSc candidate, Lakehead University, Thunder Bay, Ontario) is studying the rare element mineralogy of Center 3 syenites, Coldwell Alkalic Complex.

Ron Vande Kemp (HBSc candidate, Lakehead University, Thunder Bay, Ontario) is studying the petrology, mineralogy and sedimentological structures and textures of the Morley sulphide-facies iron formation, Schreiber.

C.M. Barr (HBSc candidate, Lakehead University, Thunder Bay) has started a study of sphalerite geobarometry at the Winston Lake Division Mine (Minnova Incorporated).

T.C. McCuaig (HBSc, Lakehead University, Thunder Bay) completed a study entitled "Dead Horse Creek Zn-Pb-Ag Veins and Their Relationship to Other Vein Deposits of the Schreiber-Terrace Bay-Marathon Region".

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8. Northwestern Region Industrial Minerals Program—1988

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INTRODUCTION

Northwestern Ontario's third granite dimension stone quarry commenced operation in 1988, with the revitalization of a former producing white granite quarry site near Ignace. Pink granite continued to be produced from two quarries, near Vermilion Bay. Active mining at several amethyst deposits, near Thunder Bay, continued on a seasonal basis. Other industrial minerals produced in the region include white quartz, diabase, and small quantities of soapstone and marble. Exploration for industrial minerals in the Northwestern Region continued at a high level in 1988. Granite dimension stone and amethyst were the most actively sought commodities. Exploration programs were also conducted on graphite, lithium, and rare earth element (REE) properties.

A job training program for dimension stone quarry workers was conducted in Vermilion Bay, to help relieve the shortage of skilled labour in this field. Fifteen students received practical training in the course, developed by the Kenora Committee for Skills Development in conjunction with the Haileybury School of Mines.

The goal of the Industrial Minerals Program for the Northwestern Region is to stimulate exploration, development and production of industrial minerals in northwestern Ontario, in accordance with a province-wide strategy of stimulating development of Ontario's industrial mineral resources and related manufacturing industries.

The Northwestern Region includes the Resident Geologists' districts of Kenora, Red Lake, Sioux Lookout, Thunder Bay, Beardmore–Geraldton, and Schreiber–Hemlo.

The program is jointly funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario; and the Northwestern Region, Mines and Minerals Division, Ontario Ministry of Northern Development and Mines.

ACKNOWLEDGMENTS

This report was reviewed by K.G. Fenwick. Typing was done by C. Mack. Sample preparation in 1988 was provided, in part, by A. Petrovich.

MINING ACTIVITY

Industrial mineral production in the Northwestern Region in 1988 is summarized in Table 8.1. Producing quarries and mines are shown on Figures 8.1a and 8.1b.

GRANITE DIMENSION STONE

Vermilion Bay

Granite Quarriers (G.Q.I.) Incorporated and Nelson Granite continued to produce pink granite from quarries located in Docker Township, 12 km west of Vermilion Bay. The quarries are located in a late, ovoid–shaped, true granite plug, 1.8 km by 1.0 km, part of the large Dryberry batholithic complex. The stone is homogeneous, medium–grained, pink granite. The deposit is nearly unfractured, allowing extraction of blocks of any desired size. Therefore, extraction is possible by quarrying techniques recently developed in Finland, which involve initial loosening of extremely large blocks of stone [up to 4000 m^3 (nearly 12 000 tons)] (Smith 1987).

Nelson Granite, a division of Nelson Monuments Limited of Sussex, New Brunswick, quarries the pink granite year-round. Production in 1988 is estimated to be in the order of 3000 m^3 (100 000 cubic feet). Most production is shipped as rough blocks to fabrication plants in eastern Canada and a number of locations in the United States, where it is transformed into monuments and architectural products.

Nelson Granite operates a small fabrication plant at the quarry site, comprising: two wire saws, a diamond trim saw, a semi-automatic polishing machine, manual polishing machines, and a hydraulic splitter. The plant primarily produces monuments and monument bases. Pavers, landscaping pieces, curbing, tables, and counter tops are also manufactured to custom specifications. The plant is also employed to perform test sawing and polishing of gran-

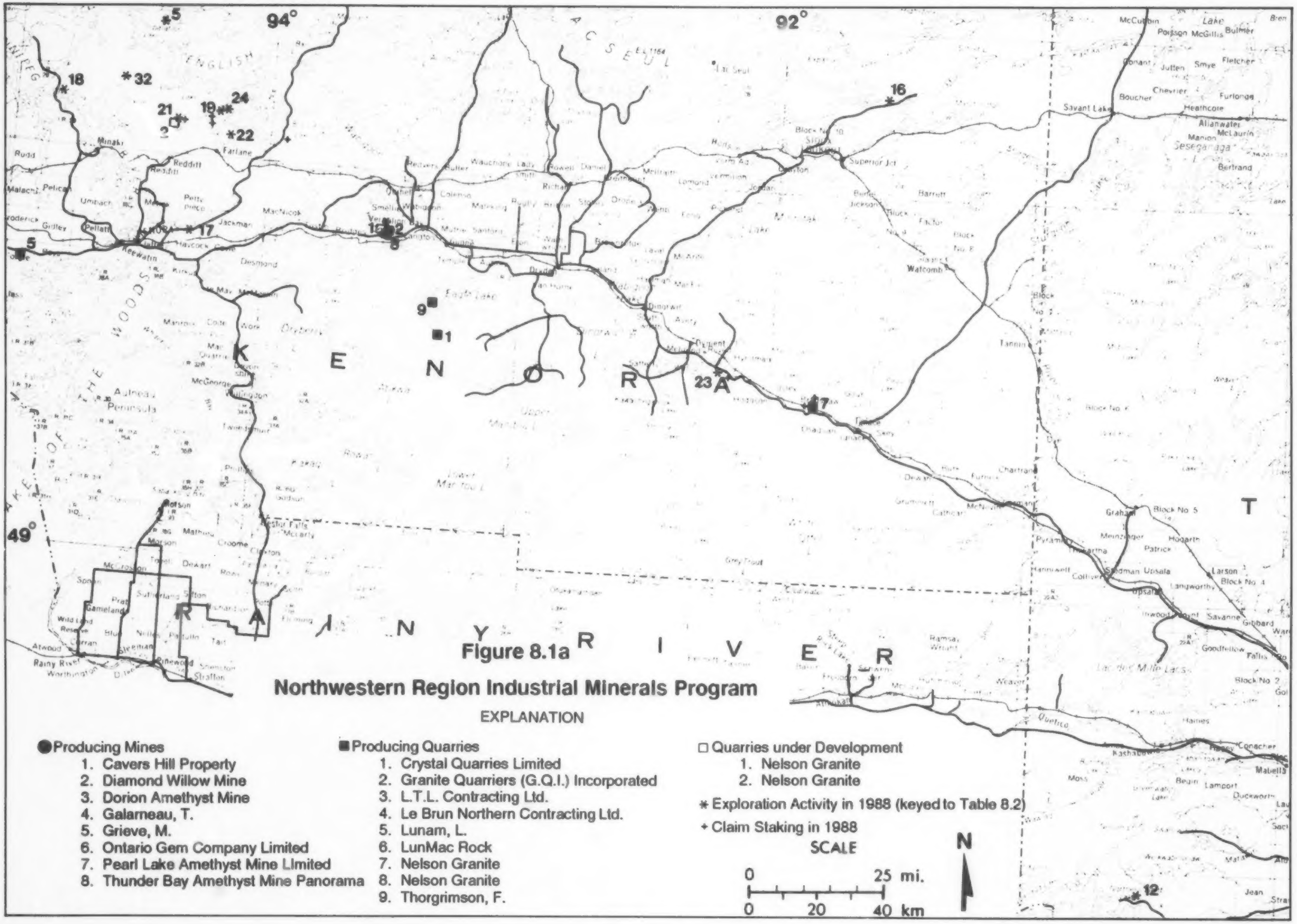

94°
92°
49°
K E N O R A
R A I N Y R I V E R
T
LAKE OF THE WOODS
ENGLISH
LAC SEUL
Lac des Mille Lacs
Kenora
Keewatin
Dryden
Ignace
Savant Lake
Sioux Lookout
Superior Jct
Fort Frances
Rainy River
Atikokan
Eagle Lake
N
0 25 mi.
0 20 40 km
SCALE
*5
*18
*32
21
2
19
24
*22
*17
5
16
9
1
8
2
12
23
A
7
*12

Figure 8.1a

Northwestern Region Industrial Minerals Program

EXPLANATION

● Producing Mines

1. Cavers Hill Property
2. Diamond Willow Mine
3. Dorion Amethyst Mine
4. Galarneau, T.
5. Grieve, M.
6. Ontario Gem Company Limited
7. Pearl Lake Amethyst Mine Limited
8. Thunder Bay Amethyst Mine Panorama

■ Producing Quarries

1. Crystal Quarries Limited
2. Granite Quarriers (G.Q.I.) Incorporated
3. L.T.L. Contracting Ltd.
4. Le Brun Northern Contracting Ltd.
5. Lunam, L.
6. LunMac Rock
7. Nelson Granite
8. Nelson Granite
9. Thorgrimson, F.

☐ Quarries under Development

1. Nelson Granite
2. Nelson Granite

* Exploration Activity in 1988 (keyed to Table 8.2)

+ Claim Staking in 1988

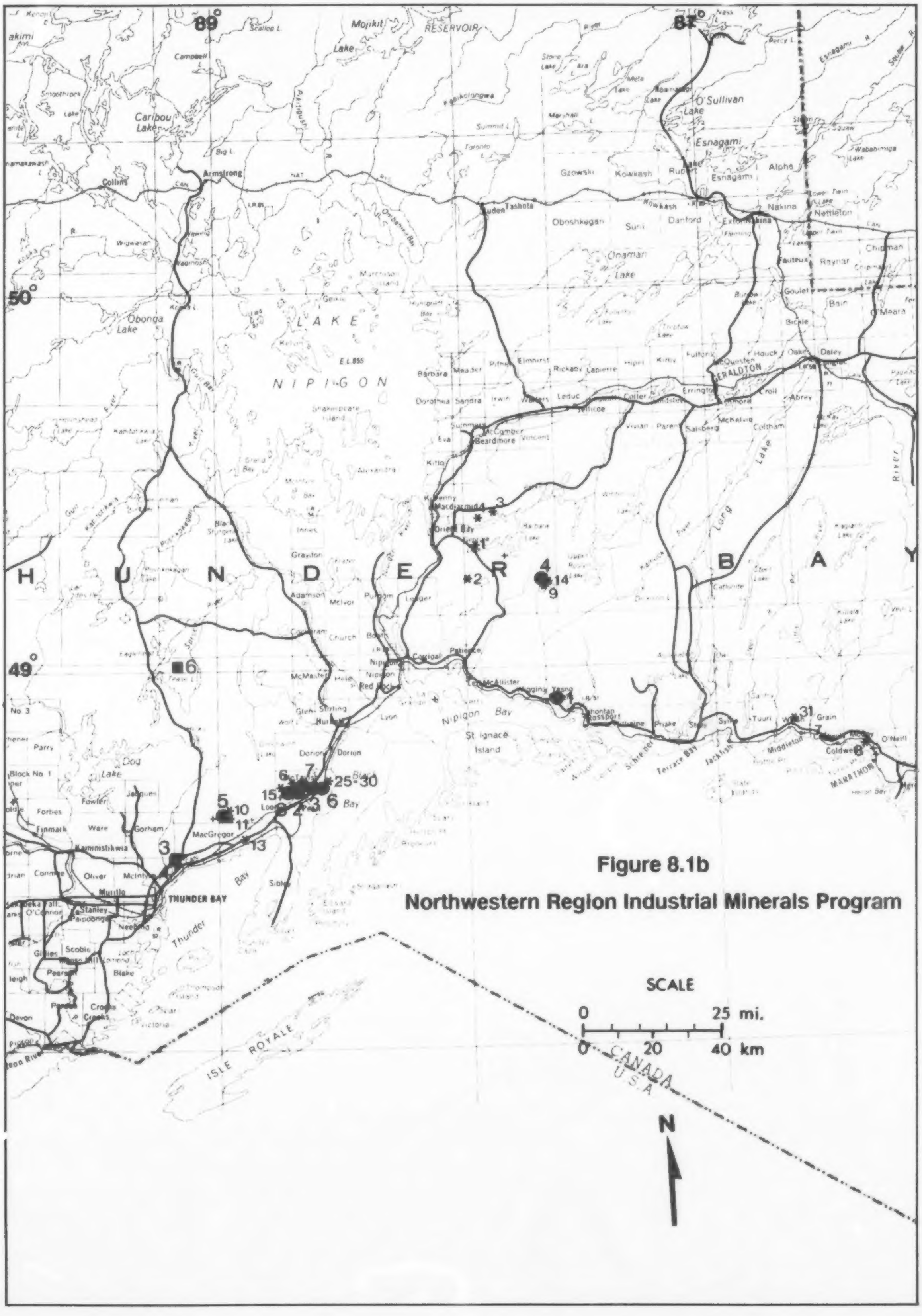

89°
87°
50°
49°
Mojikit Lake
RESERVOIR
Caribou Lake
Armstrong
Collins
Obonga Lake
LAKE NIPIGON
O'Sullivan Lake
Esnagami Lake
Nakina
Onaman Lake
GERALDTON
Beardmore
Macdiarmid
Orient Bay
Long Lake
THUNDER BAY
Nipigon
Red Rock
Dorion
Nipigon Bay
St Ignace Island
Rossport
Schreiber
Terrace Bay
Marathon
Dog Lake
Thunder Bay
Black Bay
ISLE ROYALE
CANADA
U.S.A.
H U N D E R B A Y
SCALE
0
25 mi.
0
20
40 km
N
1
2
3
4
5
6
7
8
9
10
11
13
14
15
25-30
31

Figure 8.1b
Northwestern Region Industrial Minerals Program

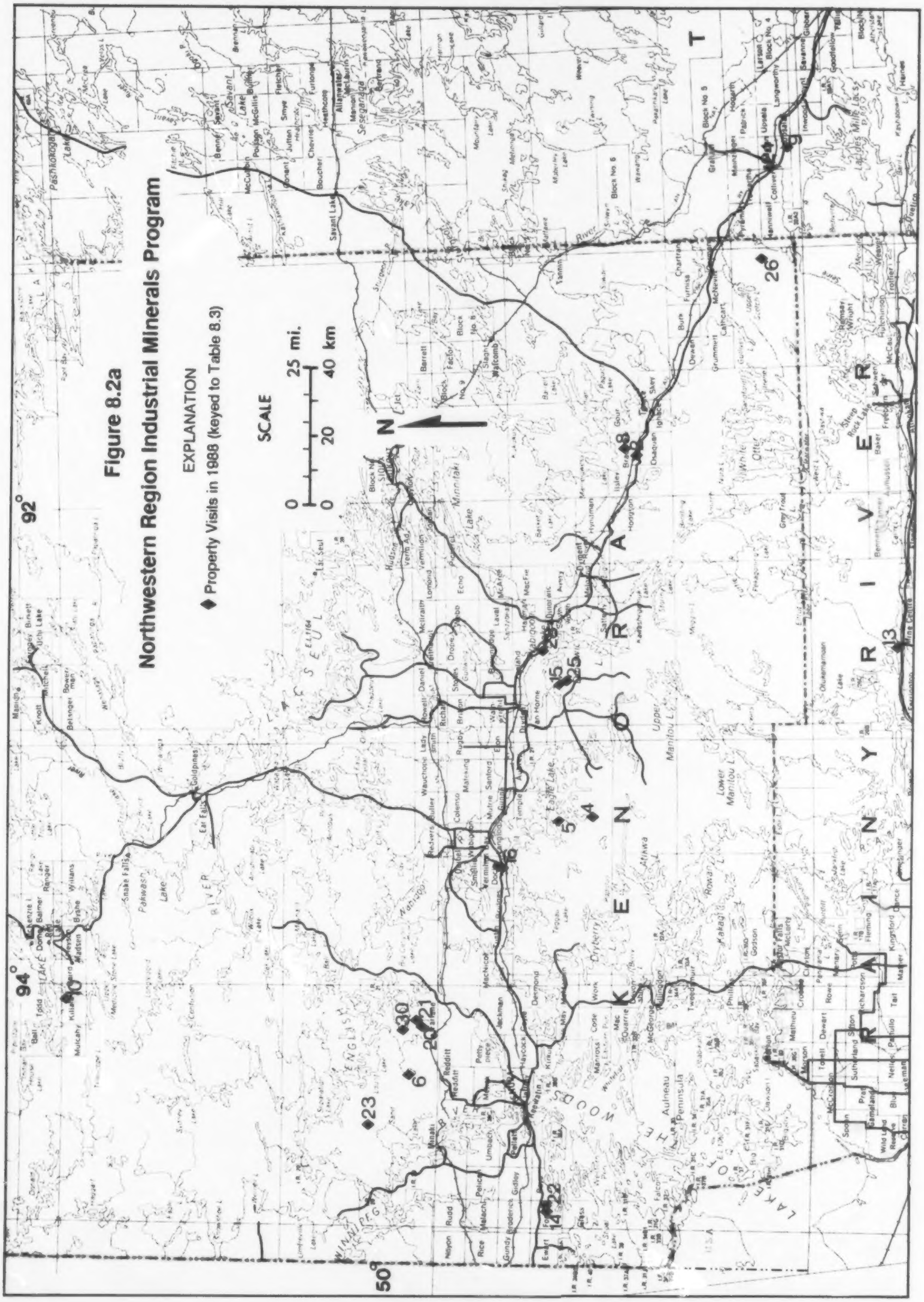


Figure 8.2a

Northwestern Region Industrial Minerals Program

EXPLANATION

◆ Property Visits in 1988 (keyed to Table 8.3)

SCALE
0 20 25 mi.
0 20 40 km
N
94°
92°
50°
KENORA
RAINY RIVER
T
LAC SEUL
ENGLISH RIVER
LAKE OF THE WOODS
WINNIPEG R.
Eagle Lake
Minnitaki Lake
Savant Lake
Sturgeon L.
Pashkokogan Lake
Upper Manitou L.
Lower Manitou L.
Dryberry L.
Rowan L.
Kakagi L.
Aulneau Peninsula
Keewatin
Sioux Lookout
Dryden
Ignace
Fort Frances
Ear Falls
Goldpines
Red Lake
Savant Lake
10
23
6
30
20
21
14
22
16
5
4
15
25
28
18
13
26

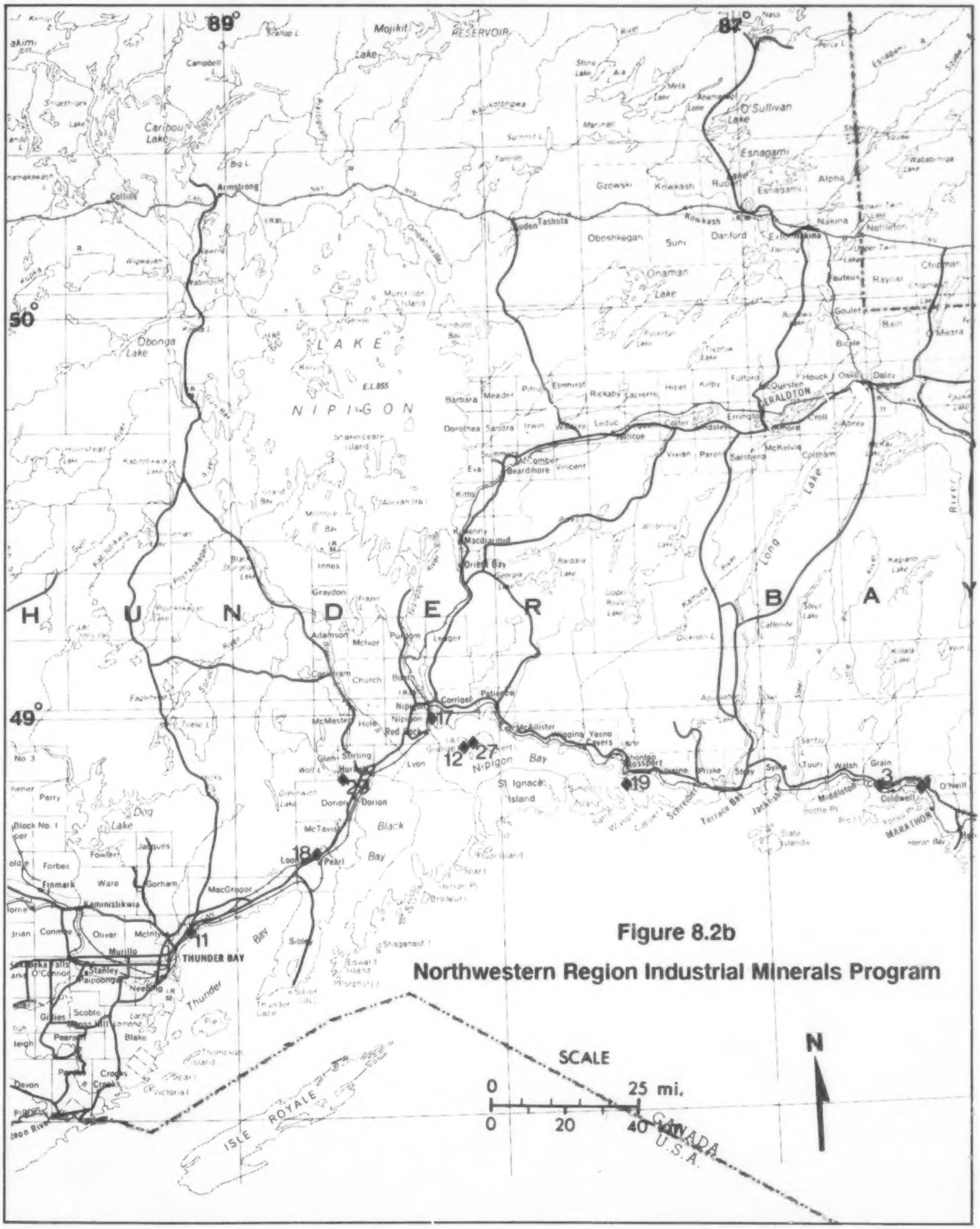

89°
87°
50°
49°
Mojikit
RESERVOIR
Caribou Lake
Armstrong
Collins
O'Sullivan Lake
Esnagami
Nakina
Ogoki
Onaman Lake
LAKE NIPIGON
GERALDTON
Beardmore
Macdiarmid
Orient Bay
THUNDER BAY
Long Lake
Nipigon
Red Rock
Dorion
Black Bay
Nipigon Bay
St Ignace Island
Rossport
Schreiber
Terrace Bay
Jackfish
Coldwell
MARATHON
Dog Lake
Kaministikwia
Murillo
11
THUNDER BAY
Thunder Bay
Sibley
17
12
27
20
18
19
3
4
ISLE ROYALE
CANADA
U.S.A.
SCALE
0
25 mi.
0
20
40 km
N

Figure 8.2b

Northwestern Region Industrial Minerals Program

TABLE 8.1. INDUSTRIAL MINERAL PRODUCERS AND SEASONAL PRODUCERS 1988.

Producer	Location	Commodity	Products/ Production
Cavers Hill Property (L. Halonen)	Yesno Twp.	amethyst	small amount of production
Crystal Quarries Limited	south of Eagle Lake	white quartz	aggregate for architectural precast panels
Diamond Willow Mine	McTavish Twp.	amethyst	specimens, decorative stone, aquarium stone; 30-40 tons produced
Dorion Amethyst Mine	McTavish Twp.	amethyst	specimens, jewellery; small amount of production
Galarneau, T.	Kabamichigama Lake	amethyst	specimens; small amount produced
Granite Quarriers (G.Q.I.) Incorporated	Docker Twp.	pink granite	rough blocks 900 m3
Grieve, M.	north of MacGregor Twp.	amethyst	specimens (<1 ton)
L.T.L. Contracting Ltd.	MacGregor Twp.	diabase	mineral wool raw material (25 000 t) construction material
Le Brun Northern Contracting Ltd.	MacGregor Twp.	diabase	rough blocks (breakwater repair); production unknown
Lunam, L.	Forgie Twp.	schist	flagstone; 40 m2
LunMac Rock	Eaglehead Lake	marble	ornamental objects; small amount produced
Nelson Granite	Bradshaw Twp.	white/grey granite	rough blocks; small amount produced
Nelson Granite	Docker Twp.	pink granite	rough blocks, slabs, monuments, pavers, landscaping items, curbing, tables, counter tops; 3000 m3
Ontario Gem Company Ltd.	McTavish Twp.	amethyst	specimens, slabbing and tumbling stone; 25 tons produced
Pearl Lake Amethyst Mines Inc.	McTavish Twp.	amethyst	decorative building stone, slabbing/tumbling stone, specimens, barite crystals; 65 tons produced
Thorgrimson, F.	Eagle Lake	soapstone	carving stone; small amount produced

TABLE 8.1. CONTINUED.

Producer	Location	Commodity	Products/ Production
Thunder Bay Amethyst Mine Panorama	McTavish Twp.	amethyst	slabbing and tumbling stone, specimens, fireplace stone, landscaping pieces, faceting grade amethyst; 1000 tons produced

ite blocks from potential new quarry sites, which Nelson Granite is investigating in northwestern Ontario. Approximately 450 m³ (15 000 cubic feet) of granite was processed at the plant this year (C. Nelson, Manager, Nelson Granite, Vermilion Bay, personal communication, 1988).

Plans by Nelson Granite to build a large–scale fabrication plant were shelved in May 1988, because of delays in opening new quarries which would supply stone to the plant.

Granite Quarriers (G.Q.I.) Incorporated produced in the order of 900 m³ (30 000 cubic feet) of pink granite from May through October 1988. Rough blocks of granite from the quarry are shipped to processing plants in eastern Canada and the eastern United States for manufacturing of monuments and architectural stone (R. Cloutier, Quarryman, Granite Quarriers (G.Q.I.) Incorporated, Vermilion Bay, personal communication, 1988).

Ignace

Nelson Granite initiated production of white (grey) granite from the former Butler Station quarry site in September 1988. The quarry is located 12 km northwest of Ignace in Bradshaw Township. Under agreement with the owners, Nelson will work the three eastern claims of the former quarry property. During this year, production was limited. A few blocks were extracted from two sites and shipped to Vermilion Bay for test work. Further production is expected in 1989. The reader is referred to the Property Examination section of this report for a description of the deposit and its history.

AMETHYST

Amethyst is produced on a seasonal basis from a number of mines in the Northwestern Region. Most amethyst production is from mines located in McTavish Township, northeast of Thunder Bay. The mineral supports a small, but important, industry in the Thunder Bay area. The mines do the majority of their business during the summer tourist season; most sell amethyst on site and several offer amethyst on a "pick–your–own" basis. The main commercial products of the mines are specimens, and slabbing and tumbling stone. Some of the mines sell decorative stone for fireplaces and architectural uses. Faceting grade (gem quality) amethyst is now being produced in the Thunder Bay area. Several retail outlets specialize in amethyst products including specimens, bookends, pen sets, jewellery, souvenirs, and other giftware products. The mineral is the basis of a local craft industry.

McTavish Township Mines

The largest amethyst producer in the region is the Thunder Bay Amethyst Mine Panorama, a division of Precious Purple Gemstones Ltd. Production in 1988 was approximately 1000 tons. The majority of production was for tumbling stone, slabs for polishing, and specimens. The company also produces fireplace stone and landscaping pieces. Of particular note is their production of gem quality material. One hundred stones averaging two carats each were faceted this year. The Royal Ontario Museum in Toronto displays a 22 carat gem from the mine (Gait 1988). Thunder Bay Amethyst Mine Panorama markets their stone at the mine and through their Thunder Bay store "Amethyst Factory" as well as through other dealers (S. Lukinuk, President, Thunder Bay Amethyst Mine Panorama, Thunder Bay, personal communication, 1988).

Pearl Lake Amethyst Mines Inc. produced approximately 65 tons of amethyst this year. Most of the tonnage was for decorative building stone and the remainder for slabbing and tumbling material and specimens. They also produced 2 to 3 tons of barite crystals. Pearl Lake sells its amethyst at the mine during the summer months, and markets its products through the two "Castagne's Rocks and Minerals" shops in the area (P. Durocher, Manager, Pearl Lake Amethyst Mines Inc., Thunder Bay, personal communication, 1988).

The Ontario Gem Company Ltd. produced in the order of 25 tons of amethystine material this year. Production was primarily for specimens, and slabbing and tumbling stone. The company makes its own fashion jewellery. It sells its amethyst products, as well as local crafts, at a giftshop at the mine (P. Marino, Owner, Ontario Gem Company Ltd., Geraldton, personal communication, 1988).

The Diamond Willow Mine Property is worked by D. Noyes, and F. Grann and C. Noyes. Production is estimated at 30 to 40 tons including stone for fireplaces and rock gardens, specimens, and aquarium stone. The amethyst is marketed at the mine in the summer and rough material is sold to a variety of retail outlets (D. Noyes, Pass Lake, personal communication, 1988).

The Dorion Amethyst Mine extracted only a small amount of amethyst this year. The road to the property was closed as of July 1, preventing access. Some specimens were sold at the site and a small amount of jewellery was sold by the owner (E. Williamson, Owner, Dorion Amethyst Mine, Thunder Bay, personal communication, 1988).

The Barrett Property in McTavish Township was inactive this year (C. Barrett, Thunder Bay, personal communication, 1988).

Other Amethyst Producers

M. Grieve produced a small amount of amethyst for specimens from a property just north of MacGregor Township.

The Little Bear Amethyst Mine, located 45 km northwest of Rossport in the Kabamichigama Lake area, was inactive this year (R. Paterson, Owner, Little Bear Amethyst Mine, Kitchener, personal communication, 1988).

T. Galarneau produced a small amount of amethyst from an adjacent property on the Little Bear Quarry Road, near Kabamichigama Lake. He sells specimens at the site during the summer.

L. Halonen is reported to have produced a small amount of amethyst from the Cavers Hill Property in Yesno Township.

QUARTZ

Crystal Quarries Limited of Keewatin produced white quartz from a quarry located south of Eagle Lake. The material is extracted during the summer months. It is trucked from the quarry to a gravel pit near Dryden, where it is custom crushed, screened, and washed. Currently, the crushed quartz is sold primarily for use as aggregate for the production of architectural, precast concrete exposed aggregate panels, and other products. The principal market areas for the product are Minnesota, Chicago, and Winnipeg. The quartz is shipped in bulk. The quarry was originally opened for ornamental landscaping stone, but the demand for precast concrete aggregate required that production of landscaping stone be put on hold for the year (E. Hansen, Owner, Crystal Quarries Limited, personal communication, 1988). E. Hansen continues to explore for new materials suitable for precast concrete use and landscaping stone.

DIABASE

Diabase is produced from a quarry located in MacGregor Township, just east of the city of Thunder Bay. L.T.L. Contracting Ltd. produced 25 000 tons of diabase, crushed and screened to specifications, for Partek Insulation of Sarnia. At the time of writing, 5000 tons had been shipped to the company and the remainder was awaiting shipment from the Valley Camp Inc. marine terminal. Partek has tested the diabase and found it to be a suitable raw material for its mineral wool manufacturing process. Partek produces specialized mineral wool insulation products suitable for high temperature applications such as pipe, tank, and boiler wraps.

Until this year, the diabase from the quarry has primarily been used for construction purposes and erosion control projects. A small amount has been used for decorative building stone and for landscaping stone.

Le Brun Northern Contracting Ltd. extracted stone blocks from the southern part of the quarry this year for repair and restoration of the Thunder Bay harbour breakwall.

MARBLE

LunMac Rock of Thunder Bay removed a small amount of "marble" from its Eaglehead Lake Property, located approximately 75 km north of the city. A few small blocks of the dolostone were extracted and used for the production of clocks, bookends, and other ornamental objects. The stone occurs in a variety of colours including blue–grey, white, brown, and multi–coloured. The property is described in Patterson *et al.* (1985).

SOAPSTONE

Frank Thorgrimson of Keewatin extracted a small amount of soapstone for carving of ornamental objects from the waste dump of the past producing Eagle Lake soapstone quarry (*see* description in Research by Industrial Minerals Staff). Among other objects, Thorgrimson makes Indian ceremonial pipes. He reports that powdered soapstone from the old quarry, mixed with resin, can be cast into ornamental objects resembling natural stone (F. Thorgrimson, Keewatin, personal communication, 1988).

FLAGSTONE

The flagstone quarry operated by Don Barnard Enterprises, located in Forgie Township west of Kenora, was inactive in 1988. Approximately 40 m^2 (400 square feet) of flagstone was extracted from an adjacent property held by L. Lunam of Keewatin for use in a small, decorative facing stone project.

ADVANCED EXPLORATION AND DEVELOPMENT

Advanced exploration and development sites are shown on Figures 8.1a and 8.1b.

GRANITE DIMENSION STONE

Docker Township

Nelson Granite continued development of a second quarry site in the Vermilion Bay pink granite deposit. The new site is located on a leased claim, approximately 0.7 km northwest of Nelson's main quarry and directly west of the quarry operated by Granite Quarriers (G.Q.I.) Incorporated. Extensive stripping has taken place at the site. Several major channels were opened with a jet–channeler (quarry torch). A few blocks have been extracted. The site was used for practical training of students in the Dimension Stone Quarry Worker Training Program, conducted early in 1988. Nelson Granite also continued work on several other sites in the vicinity of the Vermilion Bay quarry (*see* Kennedy and Sherlock 1988). The work involved stripping and outcrop cleaning, as well as the extraction of 20 blocks of granite from one site.

Forgotten Lake

Nelson Granite may soon begin production of yellow granite from a property near Forgotten Lake, north of Kenora. The company has been issued a quarry permit to extract the stone. Previous work on the property has included cleaning and stripping of outcrops in several locations, and the extraction of a number of granite blocks for test purposes from one site.

The deposit is part of the Lount Lake Batholith a large, complex, syntectonic to late tectonic pluton, composed predominantly of massive porphyritic granodiorite and porphyritic quartz monzonite (Breaks *et al.* 1978). The stone is a medium– to coarse–grained, porphyritic "granite" composed of yellow, potassic feldspar phenocrysts in a matrix of plagioclase, potassic feldspar, quartz, and biotite. On the whole, the rock is quite homogeneous, although streaky areas and a few inclusions were observed. Large blocks can be extracted from surface as the deposit is largely unfractured. The stone is a very unusual colour and has already attracted market attention for both monumental and architectural applications.

EXPLORATION ACTIVITY

Exploration activity for industrial minerals in the Northwestern Region is summarized in Table 8.2. The locations of exploration projects are indicated on Figures 8.1a and 8.1b.

GRANITE DIMENSION STONE

Interest in dimension stone in northwestern Ontario increased in 1988. This is indicated by a significant amount of claim staking and exploration activity, as well as the acquisition of several previously staked properties by granite quarrying companies. Approximately 154 new claims were staked for granite in 1988.

The main targets of dimension stone exploration and development are the granitic rocks north of Kenora, white and grey granitic rocks in the Ignace–Dryden area, and the dark coloured syenites near Marathon. Much of the exploration activity in the Northwestern Region described in Kennedy and Sherlock (1988) continued this year and is included in Table 8.2. The most significant developments for 1988 are described below.

Lount Lake Batholith

A number of potential quarry sites are being investigated in this large (2058 km^2) batholith, located north of Kenora (Kennedy and Sherlock 1988). Some new prospects were staked in the area, but little new work was carried out on any of the properties this year while environmental issues in the area are being resolved. Some progress, however, can be reported on two properties. Late in 1988, Nelson Granite received approval to begin quarrying near Forgotten Lake (*see* section entitled Advanced Exploration and Development). George Zebruck conducted geological mapping and a radiometric survey on a red granite property near Snook Lake. Zebruck optioned the property to Kenora Gold Occurrences Inc. in September. The company plans to remove some test blocks and carry out sawing and polishing tests, physical properties testing, and a market study for the stone. The Snook Lake Prospect is described in the Property Examinations section of this report.

Revell Batholith

Nelson Granite continued work on a white granite deposit located adjacent to the Trans–Canada Highway near Borups Corners, between Ignace and Dryden. The deposit is a medium–grained, equigranular, white granodiorite containing up to 10 percent biotite. Previous work on the property comprised extraction of a single test block. Tests performed on the sample, including sawing and polishing tests, preparation of test monuments, physical properties testing, and marketing, all yielded positive results (Resident Geologist's Files, Ministry of Northern Development and Mines, Kenora). This year, a bulk sample consisting of a number of large blocks was removed from the site and a significant amount of stripping was carried out.

Yett Lake Pluton

A preliminary evaluation of a granite property located east of Sioux Lookout on Hwy. 617 was conducted (Resident Geologist's Files, Ministry of Northern Development and Mines, Sioux Lookout). The property is owned by H. Lundmark of Thunder Bay. The stone is a very unusual, medium–grained, blue–quartz–bearing granitic rock, which varies in colour from pink to grey. The stone would appear to

TABLE 8.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure 8.1.	Individual or Company (Location)	Activity
1.	Armeno Resources Inc. (Barbara Lake) (Newkirk-Vegan Lithium Dep.)	stripping, geological mapping
2.	Armeno Resources Inc. (Hanson Lake and Cosgrave Lake) (MNW Lithium Dep.)	stripping, trenching, sampling
3.	Armeno Resources Inc. (Jean Lake) (Foster-Lew Lithium Dep.)	geological mapping, VLF-Mag survey
4.	Armeno Resources Inc. (Jean Lake) (Jean Lake Lithium Dep.)	stripping, VLF-Mag survey
5.	Bellwether Resources Ltd. (Treelined Lake)	stripping, trenching, sampling, assaying, EM, Mag
6.	Castagne, Eleonore (McTavish Twp.)	stripping, trenching
7.	Cold Spring Granite (Canada) Ltd. (Coldwell Twp.)	test block removal
8.	Cold Spring Granite (Canada) Ltd. (Marathon) (Pic & McCoy Twps.)	test block removal
9.	Dampier, Gerard (Kabamichigama Lake)	stripping, trenching
10.	Grieve, Michael (MacGregor Twp.)	stripping, trenching
11.	Harty, Richard Harty, Onni (MacGregor Twp.)	stripping, trenching
12.	Holzem, Martin H. and Holzem, Jerlyn (Titmarsh Lake)	stripping, trenching
13.	Karkkainen, Alpo (MacGregor Twp.)	drilling, prospecting
14.	Laporte, Eldon J. (Kabamichigama Lake)	stripping, trenching
15.	Lukinuk, Steven W. (McTavish Twp.)	geology, stripping
16.	Lundmark, H. (Kimmewin Lake Area)	preliminary evaluation
17.	Nault, Pierre Mystery Mountain Minerals Ltd. (Haycock Twp.)	petrographic studies
18.	Nault, Pierre Mystery Mountain Minerals Ltd. (Swan Lake)	petrographic studies
19.	Nault, Pierre Mystery Mountain Minerals Ltd. (Wonderland Lake)	petrographic studies
20.	Nelson Granite (Docker Twp.)	stripping, block extraction
21.	Nelson Granite (Forgotten Lake)	stripping, test block extraction
22.	Nelson Granite (Red Deer Lake)	stripping, bulk sample removal, physical properties testing, sawing/polishing tests

TABLE 8.2. CONTINUED.

Number on Figure 8.1.	Individual or Company (Location)	Activity
23.	Nelson Granite (Revell Twp.)	stripping, test block removal
24.	Nelson Granite (Wonderland Lake)	test block extraction
25.	Pearl Lake Amethyst Mines Inc. (McTavish Twp.)	stripping/trenching
26.	Redden, J.W. (McTavish Twp.)	preliminary evaluation
27.	Richardson, William G. (McTavish Twp.)	stripping, trenching
28.	Twomey, Timothy J. (McTavish Twp.) (Big Pearl Lake Property)	stripping
29.	Twomey, Timothy J. (McTavish Twp.) (Black Bay Property)	EM, Mag, geology
30.	Twomey, Timothy J. (McTavish Twp.) (Breezy Lake Property)	geology, radiometric survey
31.	Unocal Canada Limited (Walsh Twp.) (Dead Horse Creek)	soil geochemistry, radiometric, Mag, geology survey, sampling
32.	Zebruck, George (Snook Lake)	geology, radiometric survey

have good market potential. Exposure is somewhat limited. Further work will be required to determine if the deposit is suitable for dimension stone quarry development.

Coldwell Alkalic Complex

A number of granite properties in the Coldwell Complex, near Marathon, were optioned to granite companies this year and further staking also took place. Potential deposits of black, brown, green and red "granite" are found in the area. They represent different syenitic phases of the intrusive complex. Commercial granite was produced from a number of sites in the area from 1928 to 1932. The history of stone quarrying near Marathon is summarized in Patterson *et al.* (1985).

Cold Spring Granite (Canada) Ltd. optioned several properties in the area from D. Petrunka of Thunder Bay. They include black, green, brown and red granite prospects. Test blocks were extracted from two sites for preliminary testing, including sawing and polishing, physical properties testing, and market evaluation. Cold Spring received a grant under the Resource Diversification and Development Subprogram of the Northern Ontario Regional Economic Development Program (NOR–DEV) for evaluation of these properties.

A black granite property in the area was optioned by Palin Granite Canada Inc. from P. Culhane of Thunder Bay.

AMETHYST

Exploration for amethyst occurred in several areas. McTavish Township is the centre of a great deal of prospecting for the mineral. The various producers in the township, in particular Thunder Bay Amethyst Mine Panorama and Pearl Lake Amethyst Mines Inc., continued exploration and development work near their mines and on other properties. J. Redden carried out preliminary evaluation of a property which includes several amethyst veins as well as the Old Caribou Mine, a lead–zinc occurrence. T. Twomey holds three properties in McTavish Township with amethystine quartz veins. He carried out a variety of surveys, including geology, magnetic, electromagnetic (EM) and radiometric, in order to delineate mineralized fault structures on the properties. He also did some stripping on one property, near Big Pearl Lake. W. Richardson also carried out some stripping and trenching on a property in McTavish Township.

In the MacGregor Township area, stripping and trenching were carried out on properties owned by A. Karkkainen, M. Grieve, and R. Harty and O. Harty.

Near Kabamichigama Lake, E. Laporte and G. Dampier worked on amethyst properties.

M. Holzem and J. Holzem did some stripping and sampling of an amethyst showing near Shaco Lake.

A new amethyst showing was discovered, near Nipigon in Corrigal Township, by D. Stenlund.

LITHIUM

Armeno Resources Incorporated continued investigation of a number of lithium properties in the Georgia Lake area, south of Beardmore. The company has been active in the area since 1983. During this time, it has acquired and explored the following deposits: the Newkirk–Vegan, the Noranda–McVittie, the Jean Lake, the M.N.W., and the Foster–Lew (*see* Kennedy and Sherlock 1988). Work reported in 1988 includes stripping and sampling of most of the properties, and geological mapping of the Foster–Lew Property and the Newkirk–Vegan Property. Chemical analysis indicated an overall lithia content of approximately 1 percent (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). VLF–EM and magnetic surveys were carried out on the Jean Lake and Foster–Lew deposits, but this method proved unsuccessful in defining the pegmatite dikes, or in locating their extensions.

The spodumene pegmatites of the Georgia Lake area were discovered and extensively explored in the mid–1950s. However, lack of an adequate market resulted in minimal development (Pye 1965), and the area has generally remained inactive until recently. The common minerals of the pegmatite dikes are microcline, perthite, albite, quartz, spodumene, and muscovite. Accessory minerals are apatite, beryl, bityite, cassiterite, clevelandite, columbite, garnet, huhnerkobelite, molybdenite, petalite, purpurite, sericite, talc, tourmaline, and minor lepidolite and amblygonite (Hewitt 1967; Milne 1962; Breaks 1980). Interest in the Georgia Lake pegmatites has been renewed because of anticipated increases in demand for lithium metal, ceramic grade spodumene, and rare elements.

RARE EARTH ELEMENTS

In 1988, Unocal Canada Limited continued work on the Dead Horse Creek yttrium property, located 26 km northwest of Marathon. The company optioned the 26–claim property in late 1987 from JET Mineral Exploration and Omer Belisle. The property includes most of the Dead Horse Creek Diatreme Complex, located just west of the Coldwell Alkalic Complex. Exploration and evaluation of the two areas that comprise the property (the West Subcomplex and the "area east of Dead Horse Creek") occurred during late 1987.

In 1978, Gulf Minerals drilled eight diamond–drill holes on the property as part of a uranium exploration program. In 1988, Unocal Canada re–examined this core, presently stored in the Thunder Bay Drill Core Library, as part of its evaluation of the property. The core was logged in detail and extensively sampled.

The following description is based on work filed at the Resident Geologist's Office, Ontario Ministry of Northern Development and Mines, Thunder Bay, by Unocal Canada Limited.

Work on the West Subcomplex area included geological mapping, radiometric, magnetic, and soil geochemistry surveys over highly radioactive areas and their extensions, as mineralization tends to be associated with the most highly radioactive areas. Selected mineralized zones were also cleared, mapped in detail, and sampled. The West Subcomplex area is underlain by metasedimentary rocks, biotite schists, feldspar porphyry, and diatreme breccia.

The main mineralized zone is hosted in altered, fractured, metasedimentary rocks at the western end, and fractured diatreme in the east. The mineralized rock is massive and dull brownish–red in colour. It has an aphanitic, glassy appearance in the areas of highest grade. The main zone was traced by trenching. Samples from this zone averaged 0.058 percent Y_2O_3, 1.85 percent ZrO_2, 0.202 percent BeO, and 0.031 percent U_3O_8, over a length of 82 m and an average width of 1.5 m.

The second zone of mineralization in the West Subcomplex is a carbonate dike. It averaged 0.23 percent Y_2O_3 and 0.40 percent ZrO_2, over a length of 52 m and a width of 1.65 m.

Work in the "area east of Dead Horse Creek" involved a radiometric survey and sampling. The area is underlain by four bodies of diatreme breccia within metasediments and metavolcanics. Zones of high radioactivity may be related to either diatreme breccia or carbonate–rich dikes. These "high" zones were sampled. Eleven of 41 samples yielded >0.10 percent Y_2O_3.

Sampling of the property was conducted by Ministry of Northern Development and Mines staff and is reported in Schnieders and Smyk (this volume).

Rare earth elements encompass the lanthanide elements (Atomic Numbers 57 through 71). Scandium and yttrium are also considered part of this group because of their chemical similarity to the true lanthanides. Generally, the rare earths are classified as "light" rare earth elements (LREE) and "heavy" rare earth elements (HREE). These classifications are named according to the most abundant element. Since cerium tends to be more abundant than other LREE, they are referred to as the cerium–group. Yttrium is most abundant with HREE, thus the name the yttrium–group (King 1987; Shannon 1983).

Rare earth elements are commercially derived from the phosphate minerals, monazite and xenotime, and the carbonate mineral bastnaesite (Harben and Bates 1984). The bulk of rare earths are produced as by-products of mining operations for heavy minerals (titanium and zirconium), tin, phosphate, iron, and uranium (Moore 1980). Typically, the rare earth elements are associated with alkalic, carbonate, and peralkalic igneous rocks, and their related metasomatic alteration zones and hydrothermal systems (Allan 1987). Rare earth elements also occur as secondary concentrations in placer, beach sand, and phosphatic sedimentary deposits (King 1987).

An expanding market for rare earth elements has resulted in a renewed interest in the occurrences of northwestern Ontario.

GRAPHITE

Investigation of a flake graphite deposit near Treelined Lake, located 60 km north of Kenora, continued in 1988. The 20-claim property, owned by G. Zebruck and R. Kuehnbahm, was optioned to Bellwether Resources Ltd. Bellwether conducted a trenching and sampling program and electromagnetic and magnetic surveys over the property (Resident Geologist's Files, Ministry of Northern Development and Mines, Kenora).

The property is underlain by migmatitic granitic rocks and highly metamorphosed metasediments. This geology has been interpreted to represent an original sequence of siliceous and argillaceous sediments that has been subjected to intense metamorphism (Resident Geologist's Files, Ministry of Northern Development and Mines, Kenora).

Graphite is concentrated in narrow shear zones and disseminated in meta-arkose bands. Graphitic mineralization is accompanied by varying amounts of sulphides, primarily pyrrhotite with some pyrite and chalcopyrite. Bellwether defined graphite mineralization over a width of at least 110 m (360 feet), with a weighted average of 0.875 percent carbon. Continuous, mineralized bands were not identified across this zone. Preliminary assay results indicate that the grade varies from 0.1 to 5.69 percent carbon over 3 m (10 feet) within the zone. The strike length of the graphite mineralization is undefined.

The electromagnetic and magnetic surveys identified three linear anomalies on the property. These anomalies may have been caused by the presence of pyrrhotite. If graphite mineralization can be shown to always concur with pyrrhotite mineralization, the magnetic surveys would be an excellent tool for future exploration of the property.

TABLE 8.3. PROPERTY VISITS—INDUSTRIAL MINERALS PROGRAM (keyed to Figure 8.2).

1.	Angler Granite Property (black granite)
2.	Butler Station Quarry (white granite)
3.	Coldwell Granite Property (red granite)
4.	Crystal Quarries Ltd. (quartz)
5.	Eagle Lake Quarry (soapstone)
6.	Forgotten Lake Property—Nelson Granite (yellow granite)
7.	Granite Quarriers (G.Q.I.) Inc. (pink granite)
8.	Gummeson Occurrence (grey granite)
9.	Hay Lake Property (quartz)
10.	Killala Twp. Property (quartz)
11.	L.T.L. Contracting Ltd. Quarry (diabase)
12.	La Grange Island Quarry (red sandstone)
13.	Little Turtle Lake Quarry (soapstone)
14.	Lunam Prospect (flagstone)
15.	Mile Lake Occurrence (soapstone)
16.	Nelson Granite Quarry (pink granite)
17.	Nipigon River Quarry (marble)
18.	Pearl Quarry (red granite)
19.	Quarry Island Property (silica)
20.	Red Deer Lake Property—Canital Granite Ltd. (brown granite)
21.	Red Deer Lake Property—Nelson Granite (brown granite)
22.	Rush Bay Quarry—Don Barnard Enterprises (flagstone)
23.	Snook Lake Property (red granite)
24.	Stedman Lake Pluton (white/gray granite)
25.	Trap Lake Occurrence (soapstone)
26.	Van Nostrand Lake Stock (pink granite)
27.	Vert Island Quarry (red sandstone)
28.	Wabigoon Prospect—Wabigoon Resources Ltd. (soapstone)
29.	Wolf River Quarry (buff sandstone)
30.	Wonderland Lake Property—Nelson Granite (red granite)

INDUSTRIAL MINERALS STAFF ACTIVITIES

Industrial Minerals Program staff includes Myra Kennedy, Industrial Minerals Geologist and Elizabeth Sherlock, Staff Geologist. General activities include monitoring industrial mineral industry activity, collecting data and compiling information concerning occurrences and deposits, and consulting with prospectors, industry representatives, Resident Geologists' staff, and the public.

Thirty property visits were made in 1988. They are listed in Table 8.3 and shown in Figures 8.2a and 8.2b.

Seven field trips were led: three to the Marathon area dimension stone prospects; two to stone properties in the Ignace–Kenora area; one to the Vermilion Bay quarries; and one to the former sandstone quarry on Vert Island in Nipigon Bay of Lake Superior.

A talk entitled "Northwestern Ontario Building and Ornamental Stone Industry; Potential for Development" was presented at the Thunder Bay and Red Lake Regional Geoscience Seminars in February.

A poster display, "Industrial Minerals Activities—Northwestern Region 1987", was also presented at the above seminars. Two poster displays, "Industrial Minerals Activities—Northwestern Region 1988" and "Early Stone Industry, Northwestern Ontario", were presented at the Ontario Mines and Minerals Symposium, in Toronto in December.

Three interviews were given to CBQ Radio (CBC Thunder Bay) concerning the history of stone quarrying in northwestern Ontario.

A field trip to the Sudbury area to examine building stone prospects and properties was attended. The Canital Granite tile plant in Winnipeg, Manitoba, was visited.

A soapstone study was initiated by program staff in 1988. Preliminary results of the study are reported in the Research by Industrial Minerals Staff section of this report.

PROPERTY EXAMINATIONS

BUTLER GRANITE PROPERTY

The Butler white granite property is located in Bradshaw Township, approximately 10 km northwest of Ignace between the Trans–Canada Highway (Hwy. 17) and the Canadian Pacific Railway near the former Butler Station. The property consists of five patented claims owned by Eileen and Jim Hepp of Duluth, Minnesota. Five additional claims to the west and south of the patented ground were staked in 1988.

The property is the site of the former workings of the Butler Station Quarry (also known as Horne Quarry) owned and operated by the William Horne Granite Company. The quarry was run by William Horne and later by his son Wm. Cecil Horne (presently of Dryden) from the years 1915 to 1951 with a break from 1943 to 1946. Stone from the site was used for building stone, monuments, and paving stone. Used extensively in the city of Winnipeg, the steps leading to the Manitoba Legislative Building are constructed of the stone. Many railway carloads of dimensional stone were shipped from the quarry (Barr and Dyck 1979; Eileen Hepp, Duluth, Minnesota, personal communication, 1988). The company also dressed a small amount of stone on site (Tanton 1938). In its last year of operation, 175 m^3 (6000 cubic feet) of monumental stone and 60 m^3 (2000 cubic feet) of building stone were shipped from the quarry; most going to the United States with some to western and eastern Canada (Carr 1955).

Under agreement with the owners, two granite companies have recently contracted to begin work on the quarry property. Nelson Granite extracted a small amount of the stone in the fall of 1988.

Much of the quarry property was logged this year, revealing the early quarry workings. Four sizable quarry openings, and numerous small openings, indicate the amount of work which went on at the property. The sites are shown on Figure 8.3. Several rubble piles and debris from the shaping of granite pavers are also present. One derrick is still standing

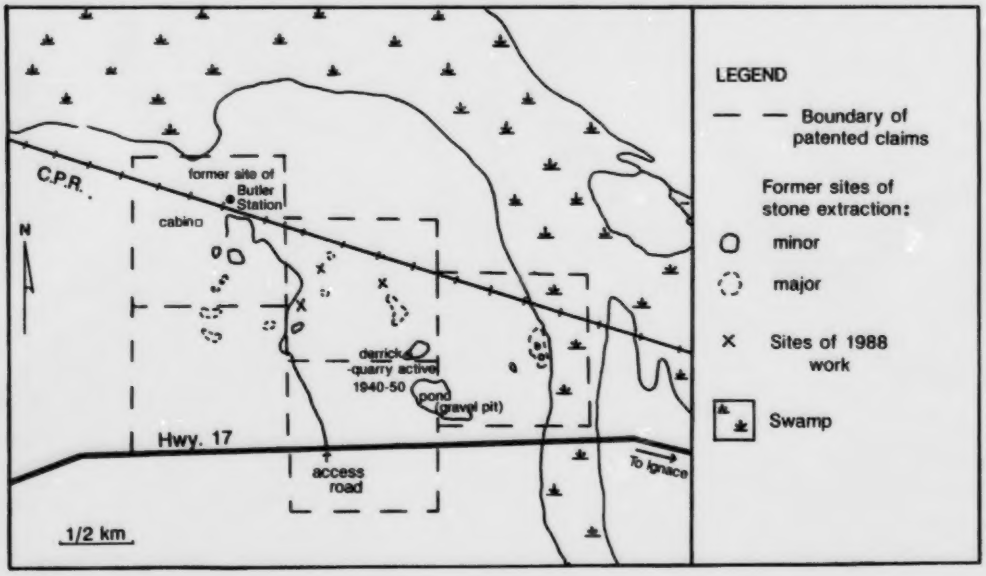


Figure 8.3. *Butler white granite property.*

and several others, which have fallen down, are still at the old quarries. Remnants of the railway siding and various buildings are still on site.

The four quarry openings are spread over a distance of nearly 2 km. The site which was most recently worked by Horne, is a very shallow quarry approximately 20 m by 60 m. Surface stone was extracted from a sheet 0.6 m thick. Two older sites to the east are deeper pits. Although both are filled with water, the stone appears to have been extracted to a depth of about 5 to 7 m. Sheeting at these sites is in the order of 1 to 3 m.

Another older site is located near the cabin on the west side of the property, near the old railway siding. A large amount of stone appears to have been extracted from this area. Two places were worked. One is quite deep (3 to 4 m), but this site appears to have been abandoned because the stone is streaky. The second site, located about 50 m to the east, has more homogeneous stone. Sheeting at this site is 1 to 2 m thick.

The deposit is part of the Cecil Lake Pluton. It has been previously described by Carr (1955), Hewitt (1964), and Storey (1986). The deposit is quite large. Overburden is thin over much of the property and roughly 100 acres appears to be underlain by potentially quarriable stone. The stone is white to light grey in colour, equigranular, and fine grained. Dark streaks are common in places. Some pegmatitic patches were observed. In places, rusty patches are observed in the stone; these appear to be related to weathering of biotite. Jointing is widely spaced. Horizontal sheeting is variable in thickness. It can be observed on the old quarry faces and tends to be 0.5 to 1.5 m thick at surface and thicker at depth.

Hewitt (1964) reported the following physical properties: compressive strength—26 125 p.s.i.; absorption—0.28 percent; bulk specific gravity—2.61; weight per cubic foot—163 pounds; and abrasive hardness—58. These are all very favourable characteristics.

Modal analysis of the rock indicates that it is composed of approximately 40 percent plagioclase, 28 percent potassic feldspar, 29 percent quartz, and 3 to 5 percent biotite (Severson analysis, Industrial Minerals Files, Ministry of Northern Development and Mines, Thunder Bay) and is therefore a true granite.

LA GRANGE ISLAND SANDSTONE PROPERTY

A former producing red sandstone quarry site on La Grange Island in Nipigon Bay of Lake Superior was located this summer by Maureen and Jack Dampier of Nipigon. They subsequently staked the area.

Initial development of the quarry is reported in 1882. The Lake Superior Freestone Quarry (also known as the Stone Quarrying Company) was owned by a group of businessmen from Prince Arthur's Landing. During the year, a small dock and blacksmith shop, boarding house and stable were erected. A tramway road was cut from the quarry face to the shore, a distance of 200 to 300 yards. Eleven men were employed to extract the stone (The Weekly Herald, July 1, 1882). Some stone was shipped to Winnipeg and Chicago (The Weekly Herald, February 14, 1883). Representatives of the CPR apparently visited the site in 1882 in order to test the stone for use in bridge construction (The Weekly Herald, October 17, 1882). It is not reported whether or not the stone was ever used by the railway. There are no further references to the quarry. The authors suggest that the site was abandoned before extensive development or full production.

At the same time, development of a sandstone quarry was taking place on adjacent Vert Island. The Vert Island Quarry produced a significant amount of stone. It is described in Patterson *et al.* (1985).

The La Grange Island quarry site is located about 250 m northwest of a small bay on the eastern side of the island. The quarry is a small opening (4 m wide by 10 m deep) in the face of a ridge that trends north to northwest for approximately 600 m. At the opening, there is an elevated rubble ridge, 2 m high and 3 m wide, extending 30 m out from the cliff face. This is presumably the base for the tramway that appears to have been abandoned before completion. At the end of the tramway is a small cart that was probably used in the construction of the base. Also at the quarry site is a small grout pile located on the southern side of the tramway. Most of the waste blocks are large sheet–like pieces of stone up to 2 m by 2 m in size and less than 30 cm thick. Some smaller blocks, approximately 50 cm per side and 40 cm thick, are also found in the grout pile.

The sandstone at La Grange Island is an arenite of the Pass Lake Formation of the Proterozoic Sibley Group. The stone has a very consistent brick–red colour. It contains few blemishes or reduction spots. Sedimentary features, such as cross–bedding and pebbly layers, are common in the vicinity of the quarry. The sandstone splits into thin sheets, 2 to 30 cm thick, along bedding planes. The sheeting does not appear to be just a surface feature, since it continues with depth into the quarry face.

While it does not appear that large blocks of sandstone could be extracted from the site, the property may have excellent potential for production of flagstone. The composition of the sandstone would appear to be similar to that on Vert Island, which is 80 percent silica. Abrasion resistance in the order of 25 could be expected for the sandstone, based on results of tests on Vert Island stone. This is very favourable and would make the stone ideal for flagstone applications.

SNOOK LAKE PROPERTY

This red granite property is located approximately 50 km north of Kenora. It can be reached via Hwy. 596 (Minaki Road) and the Sand Lake Road, north of the Winnipeg River. A logging road, leading north off the Sand Lake Road, goes right through the property. The site is a rounded, steep–sided knoll about 30 m high. Two claims staked by George Zebruck cover the prospect. It has recently been optioned to Kenora Gold Occurrences Inc.

The deposit is located near the boundary between the Lount Lake and Tetu Lake batholiths. It comprises a small, late granitic plug (250 to 300 m across) surrounded by gneissic granite. The plug has characteristics similar to the Lount Lake intrusive rocks seen elsewhere.

The stone is a bright red, porphyritic granite consisting of red to pink, potassic feldspar phenocrysts (0.5 to 1.0 cm in length) in a matrix of quartz, potassic feldspar, plagioclase, and biotite. Locally, biotite forms up to 50 percent of the matrix. The colour of the granite varies somewhat with the density of phenocrysts. The deposit contains a few small gneissic inclusions and occasional pegmatitic veins. Fractures or joints are widely spaced (3.8 to 5 m). Fractures with an orientation of 040° are most common. Sheeting is commonly 1.5 to 2 m in thickness.

The bright colour, homogeneity of the stone, potential for extraction of very large blocks, and accessibility are all very favourable characteristics of this deposit. It has excellent potential for development as granite dimension stone.

RESEARCH BY INDUSTRIAL MINERALS STAFF

SOAPSTONE STUDY

Introduction

Soapstone is defined as an impure, massive, compact form of talc, which can be easily sawn or machined. The composition tends to be a mixture of talc, serpentine, chlorite, and dolomite, with small percentages of quartz and calcite. Soapstone is characterized by its softness, resistance to chemical and thermal decomposition, and high heat capacity (Prud'homme 1987).

In North America, indigenous people were the first to recognize the ease in shaping the material, and began quarrying it on a small scale to fashion pipes, bowls, pots, and other small utensils. The tradition of carving stone remains very popular amongst aboriginal, and other, artists. It is reported that carvers will use any stone that is easily worked, including serpentinite and argillite (Gibbons 1987).

The chemical and thermal inertness of soapstone made it an ideal material for furnace linings in pulp mills, table tops and sinks for laboratories, residential heating and cooking stoves, plus a variety of other uses. Soapstone has been replaced in most of its previous applications by improved technology and better materials.

Recently, however, soapstone stoves and fireplaces have been gaining popularity in Europe and North America. This is possibly due to the high efficiency, and cleaner burning character, of these stoves. One company experiencing great success with soapstone stoves is Suomen Vuolukivi Oy of Finland. The soapstone from their Finnish quarries is marketed under the commercial name of Tuli Kivi (meaning Fire Stone), and is fabricated into various items including cookware, giftware, and tile. Their most popular item, the fireplace and stove units, are sold as kits to be assembled by the consumer. Suomen Vuolukivi Oy has anticipated a large market for their products in North America and, rather than continue shipping kits from Finland, they have acquired and reopened the Alberene Soapstone Quarry in Virginia, U.S.A. (Industrial Minerals Files, Ministry of Northern Development and Mines, Thunder Bay) (Dimensional Stone, Volume 4, Number 7, October 1988). Manufacturing is done in the modernized plant at the quarry site.

Northwestern Region Study

Recognizing an increase in demand for soapstone for artistic applications, ornamental uses, and heating and cooking systems, a study of soapstone occurrences in northwestern Ontario was initiated in 1988. A literature search was conducted in order to identify known soapstone deposits and occurrences, and to collect pertinent information on each, including previous work, history of the deposit, results from tests, etc. To facilitate field work, the occurrences were divided into three groups based on size and access. The occurrences with the highest potential for economic development were placed in group one, and with the least potential, in group three. Group one soapstone occurrences were visited during the field season of 1988. Precise location, geology, size of the soapstone occurrence, and the size of block that could be extracted, were determined at each site. Samples were collected for chemical analysis and a variety of tests to determine thermal and physical properties. Samples are also being sent to the artists at Stone Studio Siku Inc. in Parry Sound to undergo carving tests.

Previous workers have identified and studied the various occurrences in northwestern Ontario. Spence (1922, 1940) and Wilson (1926) completed inventories of major talc, soapstone, and pyrophyllite occurrences across Canada. Their work was initiated by the development and success of talc mines near Madoc and the need for soapstone in pulp mills. Hewitt (1972) completed an inventory of talc occurrences in Ontario. Information about northern

Ontario soapstone and talc occurrences has been compiled and published by Storey (1986) and Vos *et al.* (1987).

The occurrences visited so far for this study include the past producing quarries at Eagle Lake and Little Turtle Lake, and major occurrences at Wabigoon, Mile Lake, and Trap Lake deposits. They are described below.

Eagle Lake Occurrence

The former quarry site is located west of Net and Prendible islands on the southwestern shore of Eagle Lake. It can be reached by boat from any number of boat launches on the northern shore of Eagle Lake, near Eagle River. The quarry is situated adjacent to the Grace Gold Mine, which was operated by the Grace Mining Company prior to 1911 and between 1920 and 1922. In the early 1920s, the Grace Mine manager, W.J. Richards of Kenora, discovered the soapstone unit on the mine property. When the gold mine failed, the company developed the soapstone quarry (Moorhouse 1941; The Daily Times–Journal, July 7, 1925). The quarry operated from 1924 through 1927 and produced approximately 310 tons of soapstone, valued at $12,600. A mill was erected at the site. The soapstone was cut into blocks and sold to pulp mills in Dryden and Winnipeg (Resident Geologist's Files, Ministry of Northern Development and Mines, Kenora; Rogers and Young 1926a, 1926b, 1928, 1929; Sutherland *et al.* 1926a, 1926b, 1928).

At present, the quarry site is approximately 10 m from the shore and filled with water. The pit is 10 m by 19.5 m and at least 4 m deep. Blocks are stacked along the southern side of the quarry. Within this pile, the blocks have been sawn to the approximate dimensions of 0.3 m by 0.7 m by 1.3 to 1.4 m. A waste dump of smaller blocks and pieces is located near the shoreline. Frank Thorgrimson has been using material from the dump as a source of stone for carving (*see* section entitled Mining Activity).

The geology of the area was mapped by Moorhouse (1941) and is shown on Figure 8.4. The soapstone unit occurs within felsic to intermediate metavolcanics. Moorhouse suggested that the soapstone unit was an altered volcanic flow; it is also possibly an altered mafic to ultramafic inclusion or dike.

The soapstone unit crops out on the lake shore. It is 13 m wide here and strikes 060° to 065°. It seems to be limited to a small area and is poorly exposed. The soapstone could not be traced along strike inland (southwest) farther than 40 m, but minor units were found on the islands that occur approximately 600 m along strike to the northeast. The soapstone is dark grey in colour and is very soft. At the shore, the outcrop is very fractured (15 cm spacing common) and contains brown, iron–carbonate veins and chlorite along slickenside surfaces. The stone appears less fractured at the quarry site, but it is difficult to evaluate due to the lack of exposed rock. The sawn blocks at the site, however, would indicate that fairly large blocks must have been extracted.

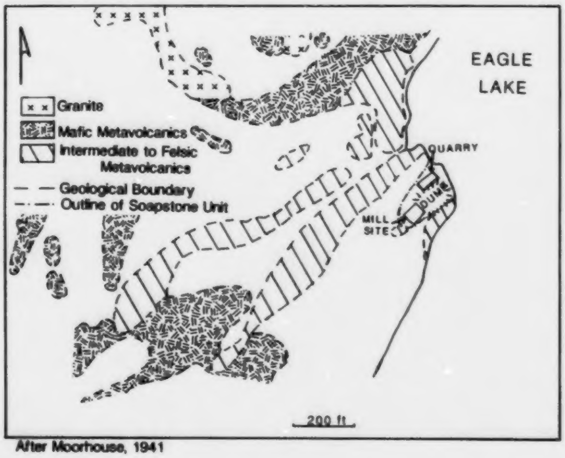
Little Turtle Lake Occurrence

A narrow soapstone unit is located on the southeastern shore of Little Turtle Lake, approximately 1 km northwest of Mine Centre. The former quarry site is situated approximately 2 km west of Misner's Landing. It can be reached by boat or on foot.

The property was originally staked prior to the 1920s. In 1922, H.H. Wood formed the H.H. Wood Talc Company and began extracting soapstone. From 1923 to 1927, approximately 50 tons of material was produced, primarily for use in steelworker's crayons and lava products (e.g., gas burner tips) (Sutherland *et al.* 1925, 1926a, 1926b; Rogers 1925a, 1925b; Rogers and Young 1926b; The Daily Times–Journal, September 15, 1923, May 8, 1924).

The geology of the area was mapped by Wood *et al.* (1980) and is shown on Figure 8.5. The area is underlain by gabbro and metavolcanics. The soapstone occurs near a contact of the gabbro with the metavolcanics, within close proximity of the Quetico fault zone. It appears to have formed as a result of alteration of the surrounding rocks. Storey (1986) reported that chlorite and hornblende are the major constituents of the soapstone.

At the time of the property visit, the area had recently flooded and only two of the three pits reported to be at the site (Storey 1986) were located. There is very little rock exposure and the two pits are overgrown and filled with water. Blocks with drill marks were found on the shore above high water and presumed to be in the vicinity of the third pit,



After Moorhouse, 1941

Figure 8.4. *Geology of the soapstone occurrence on the western shore of Eagle Lake.*

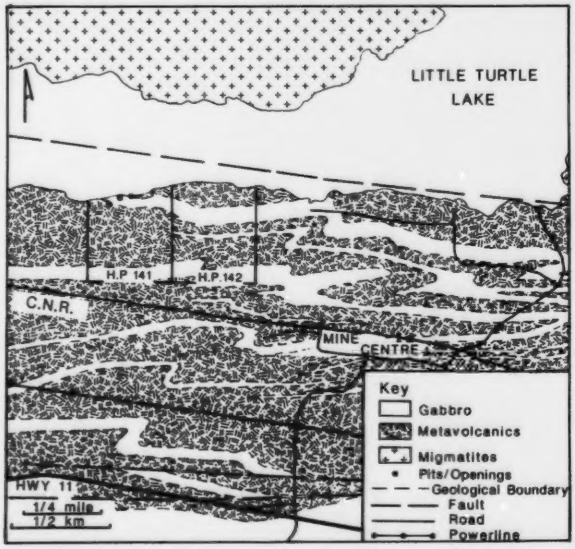
then completely underwater. Three trenches were also found in the area and are probably from earlier gold exploration activity.

Wabigoon Occurrence

This site is located approximately 1.5 km west of the village of Wabigoon on the peninsula forming the western boundary of Barrit Bay, Wabigoon Lake. The deposit can be reached by boat or by a trail that starts at the CPR right-of-way.

The soapstone was discovered in 1919 by J.D. Aaron of Wabigoon (The Daily Times-Journal, April 7, 1924). The property was sold in 1922 to E. Pidgeon who, with H.H. Sutherland, organized the Wabigoon Soapstone Company, Limited. From 1923 to 1926, the company removed test blocks and prepared blocks for the market, but no sales were reported (Rogers 1924, 1925a, 1925b; Rogers and Young 1926a, 1926b, 1928; Sutherland *et al.* 1923; Wright 1924). The area remained inactive until 1983 when Wabigoon Resources Limited acquired the property. Their initial work involved stripping and sampling the occurrence in order to evaluate the talc potential of the site.

The geology of the area is shown on Figure 8.6. The soapstone occurs within a gabbro-harzburgite unit and is believed to be the result of alteration of these rocks (Satterly 1943; Wilson 1926; Wright 1924). The area cleared by Wabigoon Resources was examined and mapped by the authors (*see* Figure 8.7). The soapstone occurs in two bands, trending northwest, separated by up to 40 m of gabbro. The northern unit of soapstone is bounded by narrow, shear zones and ranges from 10 to 15 m in width. Within this unit, there are three different types of soapstone. The first is grey in colour, up to 5 m in width, and variable in nature. The second type of soapstone is greenish-grey in colour with rusty iron-carbonate rhombs and veins. It ranges 8 to 10 m in width. The third type is green in colour, fine grained, and 0.5 m wide. The southern unit of soapstone is also bounded by shear zones. It appears more consistent throughout its width (up to 25 m). The unit is very similar to the unit within the northern band of soapstone that contains the iron-carbonate rhombs. All of the units are very fractured.



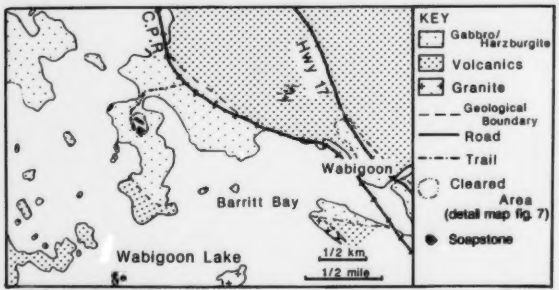
from Wood, et al, 1980

Figure 8.5. *Geology and soapstone occurrence on Little Turtle Lake, near Mine Centre.*

Mile Lake Occurrence

Soapstone occurs on the northwestern and southeastern shores of Mile Lake. The lake may be reached by boat via Contact Bay, Wabigoon Lake. The occurrence was discovered circa 1924 by the Wabigoon Soapstone Company, Limited. Test pits were sunk in the occurrence on the southeastern shore and the site was then abandoned. Test pits were sunk on the occurrence on the northwestern shore during copper-nickel exploration in the 1970s (Storey 1986).

The geology of the area is shown in Figure 8.8. The soapstone occurs within a gabbro-harzburgite intrusion which lies within granite and metavolcanics (Satterly 1943; Wilson 1926). The northwest occurrence crops out on the shoreline, near the contact between the gabbro and metavolcanics. The soapstone is a greenish-grey colour, fractured, and has a width of 0.5 to 2 m. Clay overburden does not allow the determination of strike or the extent of the deposit. The southeast occurrence is limited to an outcrop 10 to 20 m in diameter, approximately 20 m from the shore. Fractures in the rock have an average separation of 0.6 m and the stone is a blotchy green-grey colour. There is evidence of blasting and sawing of the material at the site. The two occurrences do not appear to be similar. It is reported (Satterly 1943) that the southeast occurrence is probably a highly altered, ultrabasic lens in the gab-



from Satterly, 1943 and Wilson, 1926

Figure 8.6. *Geology and soapstone occurrences, west of Wabigoon Lake.*

bro, while the northwest occurrence is metamorphic in origin.

Trap Lake Occurrence

The soapstone is located on two islands, No. 246 and No. 249, at the outlet of Trap Lake. The main occurrence is on Island No. 246. The area may be reached by boat from Wabigoon Lake via Contact Bay and Mile Lake. The property was staked in 1923 by E. Pidgeon, who organized Thermo-Stone Quarries Ltd. to quarry and market the material. By 1924, Thermo-Stone Quarries Ltd. and Wabigoon Soapstone Company were amalgamated. No further work was reported on the property (Wilson 1926).

The geology of the area was described by Satterly (1943) and Wilson (1926) and is shown on Figure 8.8. The soapstone occurs within the same gabbro-harzburgite as the Mile Lake Occurrence.

Soapstone makes up the bulk of the two islands. The stone is dark grey to black in colour with fractures and veins trending 190°, 0.5 to 2 m apart. A cliff face shows the sheeting to be 0.5 to 1.5 m thick. Towards the southern part of this island, the stone becomes less talcose and harder. The smaller island, No. 249, is composed of talcose material similar to the northern part of Island No. 246. Both islands are covered by thick overburden and outcrop is limited to the shoreline.

A number of other soapstone occurrences have been identified in the vicinity of Wabigoon Lake and Zealand Township, making the area an excellent target for exploration.

During 1989, the Industrial Minerals staff plans to complete property visits to other soapstone occurrences identified in northwestern Ontario. The study will also be expanded to encompass occurrences in other parts of Ontario.

RECOMMENDATIONS FOR EXPLORATION

Granite Dimension Stone

Several areas present excellent opportunities for granite dimension stone exploration. Criteria for dimension stone deposits are described in Patterson *et al.* (1985) and Storey (1986). The Lount Lake Batholith, north of Kenora, covers a vast region with good potential for granite prospecting. Recent mapping and study of the Dryberry batholithic complex (Sanborn-Barrie 1987) west of Dryden may reveal further exploration targets in this area. The detailed map of this batholith should be released in the spring of 1989 (M. Sanborn-Barrie, Geologist, Ontario Geological Survey, Toronto, personal communica-

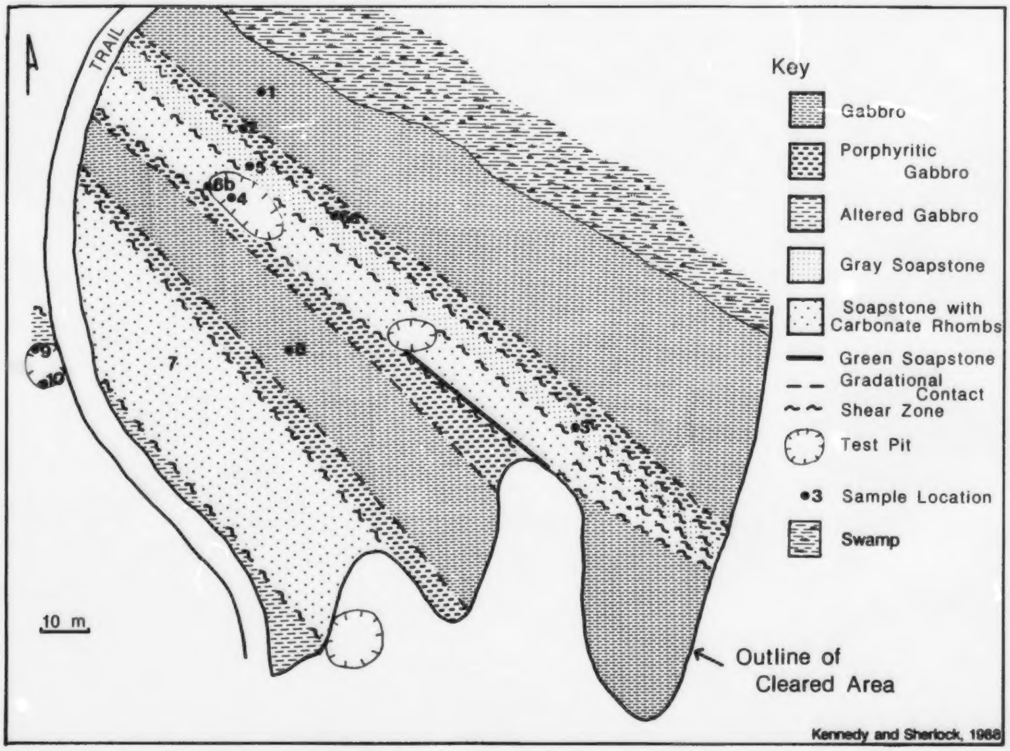


Figure 8.7. *Detailed geology of the Wabigoon soapstone occurrence.*

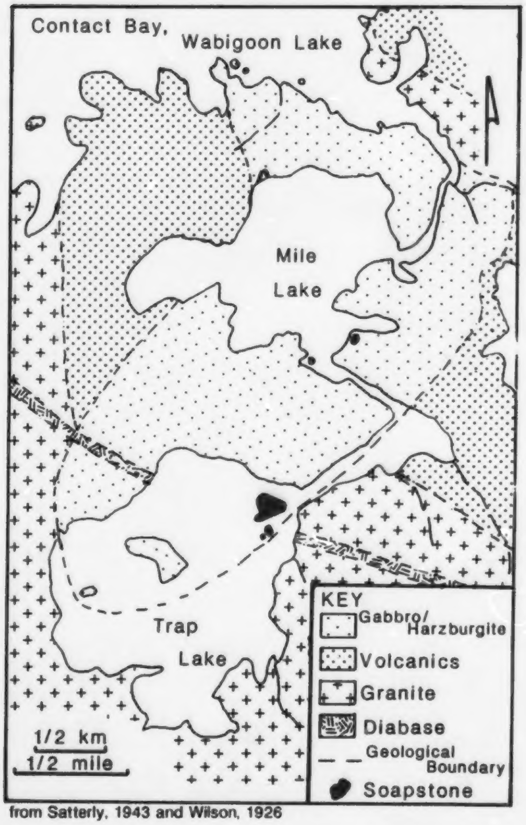
tion, 1988). Between Ignace and Dryden, the Revell Batholith, the Basket Lake Pluton, and the Cecil Lake Pluton are potential sources of white and grey granite. In the Marathon area, although much of the readily accessible prospective ground is staked, a number of areas that are less accessible should be explored for dark–coloured commercial granites.

Amethyst

McTavish and MacGregor townships are still the best targets for amethyst exploration. Other areas include the Kabamichigama Lake area and the Nagunagisic Lake area (*see* Schnieders and Smyk, this volume).

The following is from The Morning Herald, February 13, 1912, p.3:

> "Amethyst Cave
>
> A party of local snowshoe trampers have discovered a cave some six or eight miles up the Current River, the surrounding rocks being richly embellished by beautiful formations in amethyst. They brought back several fine specimens of the stone and intend revisiting the place for further exploration and to discover means of reaching this picturesque place in summer.
>
> I have been told that there are many subterranean passages similar to the one discovered last Saturday and arrangements should be made by our active publicity agents to enable visitors to view the interesting beauty spots that abound in the neighborhood. A copy of the Morning Herald, of Dec. 11, 1911, was found in the cave, proving that the dwellers, transient or otherwise, have been intelligent denizens and know a good thing when they see it."



from Satterly, 1943 and Wilson, 1926

Figure 8.8. *Geology and soapstone occurrences in the Trap Lake–Mile Lake area.*

Decorative Stone

There is a growing market for decorative crushed stone for landscaping, and for use as aggregate in the manufacture of precast concrete panels and agglomerated stone products. The type of stone required must have distinctive, bright colours such as white, red, and green. Nearly any kind of material can be used, but harder, more resistant minerals and rocks are preferred.

Sandstone

Sandstones of the Sibley Group in the Thunder Bay–Nipigon–Schreiber area may be good potential building stone deposits, if areas can be located from which large blocks can be extracted. Sandstone which can be split along bedding into sheets 3 to 6 cm thick makes excellent flagstone.

Wollastonite

Wollastonite has been identified in the Pijitawabik Bay area, Lake Nipigon. The area should be explored for sizable concentrations of the mineral.

RESEARCH BY OTHER AGENCIES

University Theses

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1988: Fluid Inclusion and Stable Isotopic Studies on Amethyst, Thunder Bay Amethyst Mine, Thunder Bay District, Ontario; Unpublished HBSc Thesis, Lakehead University, Thunder Bay.

University Researchers

B. Kronberg, Lakehead University, Department of Geology—A study of diabase as a nutrient supply for trees.

C. Masson, Lakehead University School of Engineering—A study of Northwestern Ontario clays for use as absorbants.

Other

A consultant study examining the dimension stone potential of six Indian Reserves in the Kenora area was conducted. The study was funded by the Indian Minerals East Directorate, Indian and Northern Affairs Canada and the Native Resources Commission, and coordinated by the Rat Portage Indian Band on behalf of the Grassy Narrows, Islington, Wabauskang, Dalles, and Rat Portage bands.

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9. Northeastern Region
Introduction

P.E. Giblin

Manager, Mineral Resources, Northeastern Ontario Region, Sudbury.

Exploration and development work continued at a generally high level across the Northeastern Region for the first half of the year, and then declined to more modest levels. The decline appears largely due to the impending demise of flow through share financing for exploration work, combined with the impact of the stock market crash of October, 1987.

Gold was the commodity attracting most interest, and exploration for the metal was concentrated largely in the Timmins, Kirkland Lake, and Wawa Resident Geologists' districts. The Abitibi greenstone belt attracted most of the interest in the Timmins and Kirkland Lake districts, while the Mishibishu Lake and Goudreau areas were the most active portions of the Wawa district. Gold was also of interest in the southern part of the Region, but other commodities such as base metals, platinum group elements, industrial minerals and building stone were actively sought in the Sudbury, Cobalt, and Sault Ste. Marie Resident Geologists' districts. Information concerning these exploration activities, as well as that concerning development, production, and related Ministry activities is provided in the following reports by the Resident Geologists of the region.

A total of 63 mines in the region were in production during the year. Principal commodities produced were gold, silver, zinc, nickel, copper, platinum group metals, uranium, iron ore, silica, serpentine, talc, barite, building and decorative stone, limestone and dolostone.

A highlight of the year was the opening of six new gold producers, two in each of the Wawa, Timmins, and Kirkland Lake districts, one new silver mine, and a new silica quarry.

In the Wawa District, Canamax Resources Inc. opened the Kremzar Mine, while Muscocho Explorations Limited opened the Magino Mine. Canamax Resources Inc. also opened the Bell Creek Mine, ERG Resources Inc. commenced production of gold from tailings, and Roseval Silica Incorporated began production of silica in the Timmins District. In the Kirkland Lake District, Eastmaque Gold Mines Limited started production of gold from tailings, and American Barrick Resources Corporation commenced production of gold from the Holt–McDermott Mine. Silver production commenced from the Hellens–Eplett Mine of Hellens–Eplett Mining Inc. at Cobalt.

The opening of these seven new precious metal mines was unfortunately partially offset by the closure of six precious metal mines: two gold producers in the Sudbury District and four silver mines in the Cobalt District. The Golden Rose Mine of Noramco Mining Corporation and the Scadding Mine of Orofino Resources Limited were closed in the Sudbury District. In the Cobalt District, Agnico–Eagle Mines Limited stopped silver mining operations at the Langis, Beaver–Temiskaming, and Castle Mines, and Hellens–Eplett Mining Incorporated closed its recently opened mine.

During the year significant underground exploration and development was carried out on 32 properties.

The six Resident Geologists' offices and three Drill Core Libraries in the Northeastern Region provided mineral exploration assistance and advice to approximately 9000 visitors during 1988.

Resident Geologists visited and reported upon exploration and development projects, and producing mines throughout the region. Information and geological concepts arising from this work were used to assist the minerals industry in exploration and development work, and to guide provincial and municipal goverments in land–use and regional development projects.

Much effort was directed towards increasing our knowledge of gold occurrences throughout the region. Detailed investigations, results of which are soon to be published, were made of numerous gold occurrences in the Swayze, Temagami, and Black River–Matheson areas. COMDA, the Canada–Ontario 1985 Mineral Development Agreement, a subsidiary agreement to the Economic Regional Development Agreement signed by the governments of Canada and Ontario, funded a continuing study of gold deposits near Sudbury; this and earlier work are revealing that many of the deposits are associated with a distinctive metasomatic alteration pattern which can be used as a guide to prospecting for new deposits. Reconnaissance mapping northeast of Wawa provided new data on a greenstone terrain and gold occurrences near Kabinakagami Lake. A study of the regional geological setting of gold deposits in the Matachewan–Kirkland Lake–Larder Lake area continued.

Compilation of mineral resource data continued throughout the region. Geological Data Information Folios were compiled in Wawa, and through a COMDA–funded project, in Sudbury and Cobalt. Folios are now available for many areas of high mineral potential, particularly in the Wawa, Sault Ste. Marie, Sudbury and Cobalt districts.

Interest in building stone in the Sudbury District increased greatly. In a study begun three years ago, and funded in part by COMDA in 1988 for the first time, several known stone sites, and new potential sites, have been investigated. The results have attracted the interest of several companies, including overseas stone producers. In a parallel development, a second stone–finishing plant is nearing completion in the city, enchancing the potential for development of local quarries.

Significant progress appears to have been made in resolving the long–standing problem of stratigraphic equivalence of Huronian Supergroup rocks of Ontario with Middle Precambrian rocks of Michigan. A joint project by geologists from Northeastern Region, the Ontario Geological Survey, and Lake Superior State University, demonstrated that an apparently unique Huronian dolostone unit near Sault Ste. Marie is probably equivalent to the Huronian Gordon Lake Formation, and may be stratigraphically equivalent to the Kona Dolomite of Michigan's Chocolay Group. Minor barite and copper mineralization were found in the dolostone.

Drill core was collected from numerous mineral exploration sites, catalogued, and made available for examination by industry, universities, and government.

The issue of public safety was addressed through continuing assessment of, and remedial action upon, hazards associated with abandoned mine workings in the Bruce Mines, Cobalt, Gowganda, Elk Lake, and Kirkland Lake areas.

10. Wawa Resident Geologist's District—1988

D.J.J. Tortosa[1], E.D. Frey[2], R.C. Stewart[3], A.C. Wilson[3], W. Wing[3], L. Ashick[4], J.D. Melisek[5]

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[2]Staff Geologist, Ministry of Northern Development and Mines, Wawa

[3]Contract Geologist, Ministry of Northern Development and Mines, Wawa

[4]Contract Geologist, Minstry of Northern Development and Mines, Sault Ste. Marie

[5]Drill Core Library Geologist, Ministry of Northern Development and Mines, Sault Ste. Marie

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INTRODUCTION

The Wawa Resident Geologist's Office continued into its second year of operation, providing exploration companies and the public with access to information on mineral resources, technical advice; and acting as a sales outlet for claim maps, claim tags, prospector's licences, and geological maps and publications. The number of visitors using the office doubled from what it was over the same period last year (*see* Figure 10.2); the number of visitors per month averaged about 125.

Permanent office staff consists of Delio Tortosa, Resident Geologist; Ed Frey, Staff Geologist; and Barb Leschishin, Resident Geologist's Secretary. Contract geology staff consists of Lorry Ashick, Paul Beach, Ed Haley (through to September), Rosa Stewart, Cheri Verville, Ann Wilson, and Wendy Wing. Summer contract staff consisted of J. Tait and I. Martin; K. Henson was employed through the Experience '88 program.

Over the past year, the Wawa District has continued to generate a high level of activity and interest among the mining and exploration community (*see* Figure 10.1, Table 10.1). During the year, most of the remaining available land underlain by the Michipicoten and Mishibishu Lake greenstone belts was staked. The level of exploration and claim–staking activity is reflected, in part, by the number of exploration and development programs active during 1988 (*see* Figure 10.3), and by the number of claims recorded in the District (*see* Figure 10.4, Table 10.2). A surge in the number of claim tags sold was noted in June prior to the release of the Airborne Geophysical Survey for the Wawa area. This survey was one of several Economic Development Initiatives undertaken for the Wawa area, financed by the provincial government's Northern Development Fund.

Of the four main areas of exploration and development activity (Mishibishu Lake, Goudreau–Lochalsh, Renabie–Missanabie, and Wawa–Michipicoten areas), the Mishibishu Lake area has begun to establish itself as a new gold–mining camp. Muscocho Explorations Limited's decision to bring the Magnacon gold deposit into production by early 1989 will make it the first producer for this area. Granges Exploration Limited has initiated a bulk–sampling program on the surface exposure of the Main zone, and expects to begin underground development in 1989. The Main zone is several kilometres along strike to the west of the Magnacon Deposit, and both deposits occur within the Mishibishu Lake deformation zone.

Ten kilometres south of Mishibishu Lake, Hemlo Gold Mines Incorporated and Central Crude Limited have discovered a significant gold deposit on their Eagle River Property with preliminary reserves estimated at one million tons averaging 0.27 ounce gold per ton. The discovery, which occurs within the Eagle River deformation zone, has had the catalytic effect of opening up the entire Mishibishu belt for the discovery of potentially economic gold deposits.

In the Goudreau–Lochalsh area, the Kremzar Mine (Canamax Resources Incorporated) and the Magino Mine (Muscocho Explorations Limited) were formally opened on October 4 and October 14, 1988, respectively. The opening of these gold mines represents the re–establishment of the Goudreau area as a gold mining camp. During the year, advanced exploration continued on the two significant discoveries made by Canamax Resources Incorporated, in 1987, under Goudreau Lake (the Lochalsh and Island zones). These two zones have a combined drill–indicated reserve of 1.4 million tons averaging 0.2 ounce gold per ton. The new discoveries are on–strike east–northeast from the Magino Mine and occur within the Goudreau Lake shear zone.

The increasing level of exploration, mine development, and mining activity in the Wawa District is having, and will continue to have, a significant impact on the communities in the area, particularly Wawa and Dubreuilville. In order to assist in the regional development of the area, the Government of Ontario plans to build a road link to the Goudreau area mines by way of Highway 519, with construction beginning in the spring of 1989. As well, an interministerial regional development committee has

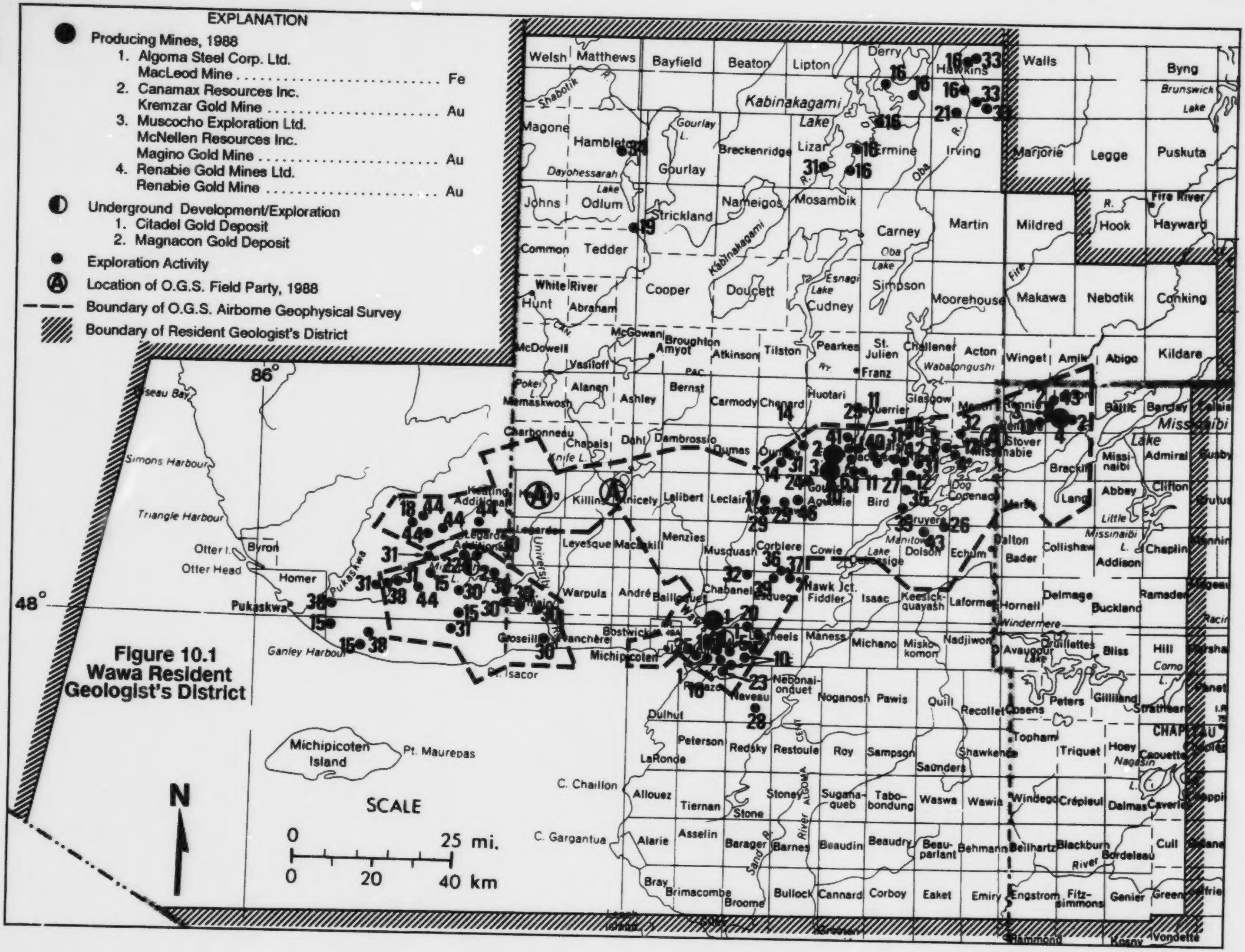

EXPLANATION
● Producing Mines, 1988
1. Algoma Steel Corp. Ltd. MacLeod Mine .... Fe
2. Canamax Resources Inc. Kremzar Gold Mine .... Au
3. Muscocho Exploration Ltd. McNellen Resources Inc. Magino Gold Mine .... Au
4. Renabie Gold Mines Ltd. Renabie Gold Mine .... Au
◐ Underground Development/Exploration
1. Citadel Gold Deposit
2. Magnacon Gold Deposit
• Exploration Activity
Ⓐ Location of O.G.S. Field Party, 1988
Boundary of O.G.S. Airborne Geophysical Survey
▨ Boundary of Resident Geologist's District
86°
48°
Kabinakagami Lake
Michipicoten Island
Pt. Maurepas
C. Chaillon
C. Gargantua
Ganley Harbour
Pukaskwa
Otter Head
Otter I.
Triangle Harbour
Simons Harbour
Missinaibi Lake
Michipicoten
Wawa
CHAPLEAU
N
SCALE
0 25 mi.
0 20 40 km

Figure 10.1 Wawa Resident Geologist's District

TABLE 10.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1.	ALLIED NORTHERN RESOURCES LTD.	PROSPECTING
2.	ANGLO DOMINION EXPLORATIONS LTD.	PROSPECTING
3.	ANGLO PORCUPINE GOLD MINES LTD.	STRIPPING
4.	ASARCO EXPLORATION CO. LTD.	GEOPHYSICS
5.	BABCOCK CONSULTING LTD.	PROSPECTING, STRIPPING, TRENCHING, DRILLING
6.	CANAMAX RESOURCES INC.	PROSPECTING, DRILLING
7.	CANLORM RESOURCES INC.	TRENCHING, DRILLING
8.	CANREOS MINERALS LTD.	DRILLING
9.	CHRIS YOUNG	STRIPPING, TRENCHING
10.	CITADEL GOLD MINES INC.	DRILLING
11.	CLINE DEVELOPMENT CORP.	LINECUTTING, GEOPHYSICS, GEOLOGY, DRILLING
12.	COMINCO LTD.	DRILLING
13.	CONQUEST YELLOWKNIFE RESOURCES LTD.	PROSPECTING, STRIPPING, DRILLING
14.	DICK MACPHERSON	PROSPECTING
15.	DOMINION EXPLORERS INC.	PROSPECTING, LINECUTTING, TRENCHING, GEOPHYSICS, GEOLOGY
16.	DURHAM GEOLOGICAL SERVICES INC.	PROSPECTING, GEOLOGY, DRILLING, GEOPHYSICS
17.	EGO RESOURCES LTD.	STRIPPING, TRENCHING, DRILLING
18.	FERDERBER GEOPHYSICS LTD.	DRILLING
19.	GLM EXPLORATION SERVICES	PROSPECTING, LINECUTTING, GEOLOGY
20.	GOLDEN POINT EXPLORATION LTD.	LINECUTTING, STRIPPING, TRENCHING, DRILLING
21.	GOLDFIELDS CANADIAN MINING LTD.	PROSPECTING, DRILLING
22.	GRANGES EXPLORATION LTD.	STRIPPING, TRENCHING, DRILLING
23.	HALLEY RESOURCES LTD.	LINECUTTING, DRILLING
24.	JAMES TILSEY & ASSOCIATES LTD.	PROSPECTING, LINECUTTING, STRIPPING
25.	JASON GERDES	STRIPPING
26.	JMS MINE CONTRACTING LTD.	PROSPECTING
27.	KOWKASH GOLD AND TRISK MINERALS	LINECUTTING, DRILLING
28.	LONGREACH RESOURCES INC. (OPERATION TRANSGOLD)	STRIPPING, TRENCHING
29.	McADAM RESOURCES INC.	PROSPECTING, DRILLING
30.	MUSCOCHO EXPLORATIONS LTD.	PROSPECTING, LINECUTTING, TRENCHING, GEOPHYSICS, GEOLOGY, DRILLING
31.	NORANDA EXPLORATION CO. LTD.	PROSPECTING, STRIPPING, TRENCHING, GEOPHYSICS, GEOCHEM, SOIL SAMPLING, GEOLOGY, DRILLING
32.	OREQUEST CONSULTANTS LTD.	PROSPECTING, LINECUTTING, TRENCHING, GEOPHYSICS, SOIL SAMPLING, GEOLOGY, DRILLING
33.	OWEN BROOK RESOURCES	DRILLING
34.	PETER NABIGON	PROSPECTING, LINECUTTING, TRENCHING, DRILLING
35.	R.S. MIDDLETON EXPLORATION SERVICES INC.	GEOPHYSICS
36.	REED LAKE EXPLORATION LTD.	PROSPECTING, TRENCHING, GEOPHYSICS, DRILLING
37.	RON BUCHANAN	STRIPPING, GEOPHYSICS, DRILLING
38.	SEARS, BARRY & ASSOCIATES INC.	LINECUTTING STRIPPING, GEOPHYSICS, GEOCHEMISTRY, GEOLOGY
39.	SOOCANA EXPLORATION LTD.	PROSPECTING, TRENCHING, GEOPHYSICS, GEOLOGY, DRILLING
40.	SPIRIT LAKE EXPLORATIONS LTD.	STRIPPING, TRENCHING, GEOPHYSICS, DRILLING
41.	SUDBURY GEOLOGICAL SERVICES INC.	DRILLING
42.	TECO MINES & OILS LTD.	GEOPHYSICS, SOIL SAMPLING, GEOLOGY
43.	TENOGA CONSULTANTS INC.	TRENCHING
44.	TUNDRA GOLD MINES LTD.	PROSPECTING, LINECUTTING, STRIPPING, TRENCHING, GEOPHYSICS, GEOLOGY, DRILLING
45.	VEGA EXPLORATIONS	STRIPPING, TRENCHING, GEOPHYSICS, SOIL SAMPLING
46.	WHITNEY PORCUPINE RESOURCES	LINECUTTING, GEOPHYSICS, GEOLOGY

TABLE 10.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1987	4,313	1,283	12,286[2]	42,232.00	208,316.00	10,138.60	640,940.88
1988	4,904[1]	970[1]	17,043[1,2]	107,929.15	204,169.00	17,972.48	38,085.74

[1] as of November 18, 1988

[2] approximate total for Sault Ste. Marie Mining Division

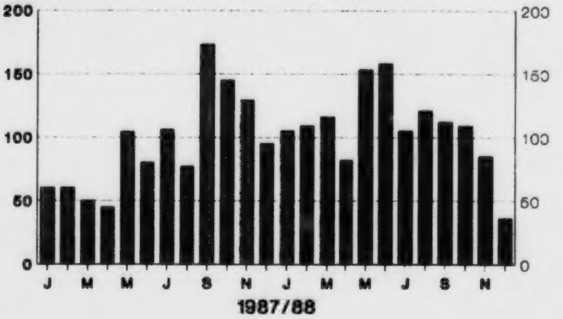


Figure 10.2. *Client services—number of visitors per month, 1987-1988.*

been established to deal with regional development issues of concern to the exploration and mining companies, and the affected communities. A Mines Impact Study for Wawa and Dubreuilville which predicts a 20 percent increase in the population of these communities by 1990 has been completed.

MINING ACTIVITY

ALGOMA ORE DIVISION

The Algoma Ore Division of The Algoma Steel Corporation Limited continued to mine siderite iron ore at the George W. MacLeod Mine in Wawa during 1988. Production through the end of November 1988 was 985 970 tons of sinter from 1 225 549 tons of ore with an average grade of 35.5 percent iron. The company has sucessfully applied statistical process control to improve quality control of ore grade and the overall efficiency of the operation. The company has a combined workforce of about 350 people and is the main employer in Wawa. In 1988, Dofasco Incorporated bought controlling in-

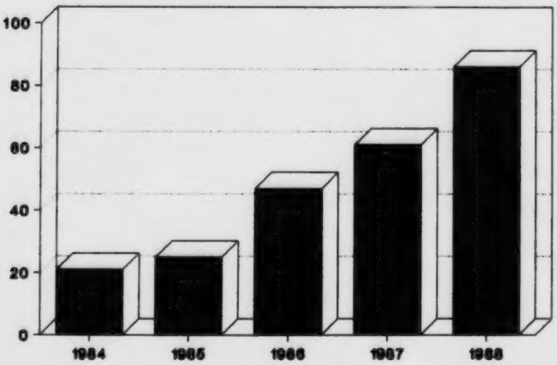


Figure 10.3. *Exploration programs in the Wawa Resident Geologist's District, 1984-1988 (based on Work Permits submitted).*

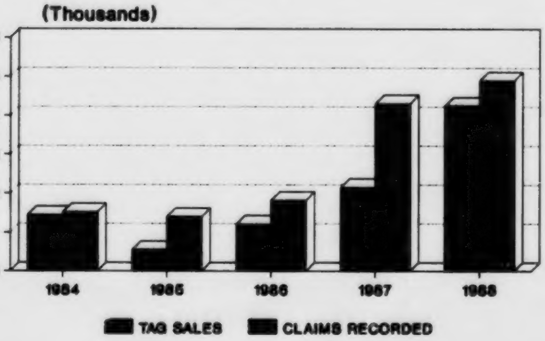


Figure 10.4. *Claim tag sales and claims recorded, 1984-1988.*

terest in The Algoma Steel Corporation Limited from Canadian Pacific Limited.

Since 1939, the Algoma Ore Division has mined 85 million tons of siderite from its underground operation. In 1989, the company will celebrate 50 years of siderite production.

RENABIE MINE

Production at the Renabie Mine, up to December 1988, amounted to 202 384 tons with an average grade of 0.194 ounce gold per ton. Mining activity during 1988 took place below the 3415–foot level, accessed by an internal ramp and winze. During the year, mine development occurred on the eight levels from 3455 to 4105 feet. Underground development drilling within ore amounted to 4226 feet. The winze, completed in 1986, provides access to working levels between 3100 and 4300 feet.

The Renabie ore zone is currently undergoing a geological and structural re–evaluation in order to better identify, and selectively mine, higher grade portions of ore. Gold occurs with pyrite in large pods and lenses of quartz up to 100 feet wide and 500 feet in length. The quartz pods and lenses plunge about 60° to the west within a steeply south–dipping shear zone (the Renabie "break") containing reddened quartz–sericite schist.

The mill has a capacity of 750 tons per day; the deposit is being mined using a sublevel–caving method. Proven reserves are 1.2 million tons with an average grade of 0.2 ounce gold per ton. The mine and mill employ about 175 people.

KREMZAR MINE

Canamax Resources Incorporated officially opened the Kremzar Mine, located in the Goudreau area, on October 4, 1988 (*see* Figure 10.1). A surface exploration program, begun in 1983 in the area of the Kremzar showing, resulted in the delineation of the Kremzar ore zone. This was followed by underground development in 1985 which established an ore reserve of 874 500 tons grading 0.189 ounce gold per ton (The Northern Miner, May 16, 1988).

Access to the orebody is made by a spiral decline to the 500–foot level, to be extended to a vertical depth of about 800 feet. The upper levels of the ore body will use a sublevel retreat mining method, whereas the lower levels will use mechanized cut and fill. A 500 ton per day mill has been designed to be expanded to an 800 ton per day capacity, and uses a carbon–in–pulp extraction process for gold recovery.

Gold production, which began in September, is expected to be near 5450 ounces for 1988. Production forecast for 1989 is 182 000 tons mined or milled at a mill head grade of 0.189 ounce gold per ton, for a total of 32 000 ounces of gold annually at an operating cost of C$295 per ounce. The mine and mill employ a total of 75 people.

MAGINO MINE

Muscocho Explorations Limited officially opened the Magino Mine on October 14, 1988. The mine is jointly owned by Muscocho Explorations Limited and McNellen Resources Incorporated. It is located adjacent to the old Magino Mine (past producer) which was worked during the 1939 to 1941 period. Exploration on the property began in 1985, on the west–southwest on–strike extension of the gold–bearing structures of the former producer, and was followed by an underground–development program in 1986. Estimated ore reserves stand at 1.9 million tons with an average grade of 0.25 ounce gold per ton calculated from diamond drilling above 500 feet.

Gold production, which began in June, is estimated to amount to 6500 ounces for 1988. Forecasted annual production is expected to be 32 000 ounces. The mill has an operating capacity of 400 tons per day and the mine and mill employ a total of about 100 employees.

The Magino orebody is reached by a spiral decline with levels at 200, 250, 350, and 400 feet below surface. Eleven drill holes indicate the continuation of significant ore grades at widths from 3 to 6 feet up to a depth of 2000 feet over a strike length of 2800 feet. Underground drilling for the year amounted to 50 000 feet at 50–foot centres, and test stoping was initiated on level two.

Gold mineralization occurs in siliceous zones and quartz veins within the shear portions of the Webb Lake granodiorite–trondhjemite stock. The orientation and location of the mineralized sheared zones is parallel and immediately adjacent to the Goudreau Lake lineament (shear zone).

ADVANCED EXPLORATION AND DEVELOPMENT

CITADEL GOLD MINES INC.

Citadel Gold Mines Inc. initiated an aggressive surface and underground exploration program under the management of Apotex Limited, a subsidiary of the Sherman Group, who took over controlling interest of Citadel in 1988. This $15.0 million program was initiated to evaluate the Citadel Property and a drill–indicated gold zone extending southward from the Jubilee Mine (past producer). This mineralized zone (the Jubilee South zone) has a surface projection 1800 feet long and 200 to 300 feet wide, and occurs within the Jubilee shear zone which hosts both the Surluga and Jubilee gold deposits. The drill–indicated possible reserve was estimated, in 1987, at one million tons grading 0.2 ounce gold per ton (The Northern Miner, September 28, 1987).

The Surluga Mine was developed in the early 1970s with six levels to a depth of 950 feet. Ore zones occur within the northeast–trending Jubilee shear zone and dip 30° to 40° east, plunging south. Ore reserves are estimated to be 518 000 tons averaging 0.23 ounce gold per ton in the Surluga Mine and 280 000 tons grading 0.2 ounce gold per ton in the downdip extension of the Jubilee Mine (the Jubilee South zone), (Citadel Gold Mines Inc. press release March 30, 1988).

Underground drifting has now accessed the Jubilee South zone on level five, and is progressing on levels three, four, and six from the Surluga Mine. The Jubilee Mine shaft (past producer) is currently being used for ventilation. A diamond–drill program of 15 000 feet (minimum) has been initiated from the fifth level and is designed to delineate the mineralization's (Jubilee South zone) outline, complimenting data obtained from surface drilling completed in 1987.

The Surluga Mill is being refurbished to process 500 tons per day. Citadel Gold Mines Inc. plans to test mine and mill ore by the first quarter of 1989, from the surface stockpile (about 36 000 tons) and from test stopes which are currently being developed. Citadel Gold Mines Inc. plans to use Minto Lake, formerly a tailings disposal site for the Minto and Jubilee mines in the 1930s, as the tailings disposal pond for the Surluga Mine.

CANAMAX RESOURCES INCORPORATED

During the year, Canamax Resources Incorporated continued to define two mineralized zones discovered last year under Goudreau Lake. The Lochalsh and Island zones are located in the southwestern end of Goudreau Lake on property which is wholly owned by Canamax Resources Incorporated (the Lochalsh Project). The ore zones have a combined drill–indicated reserve of 1.4 million tons with an average cut grade of 0.2 ounce gold per ton. During 1988, about 11 000 m of delineation diamond drilling were completed on the project and a similar amount is projected for 1989. The mineralized zones are about 2 km south of Canamax Resources Incorporated's Kremzar Mine and mill complex, and are expected to provide mill feed in the future.

A second area of gold mineralization, farther toward the east along Goudreau Lake, is on property which is jointly owned by Canamax Resources Incorporated (51 percent) and The Algoma Steel Corporation Limited (49 percent). Drilling in this area has identified a zone of gold mineralization with a strike length of about 1800 feet. During 1988, Canamax Resources Incorporated completed 17 diamond–drill holes for a total of 4900 m of delineation and exploration drilling. A similarly sized drill program is expected in 1989. No ore–reserve figures have been published to date.

Gold mineralization at both the Lochalsh Project and the Goudreau Project occur in the Goudreau Lake shear zone which also hosts the Magino gold deposit (Muscocho Explorations Limited), located several kilometres to the southwest. Gold mineralization occurs within veins and siliceous sections in a quartz–sericite schist host. The main controlling structure (the Goudreau Lake shear zone) forms part of the broader Goudreau Lake deformation zone (Heather and Arias 1987) which contains many of the gold occurrences and past producers of the area.

In addition to the drilling programs on the Lochalsh and Goudreau projects in 1988, 2500 m of exploration drilling was completed in the Kremzar Mine area in order to test the continuation of the mineralized structures.

Drilling programs for 1989 will be designed to further delineate the known mineralized zones related to the Goudreau Lake shear zone, and establish a better understanding of the geological character of the ore zones and definition of the ore reserve.

MUSCOCHO EXPLORATIONS LIMITED

A decision to bring the Magnacon gold deposit into production by early 1989 was made by Flanagan McAdam Resources Inc. (50 percent), Muscocho Explorations Limited (25 percent), and Windarra Minerals Ltd. (25 percent) last spring. The gold deposit is located in the Mishibishu Lake area and has a drill–indicated gold reserve of 1.44 million tons with an average grade of 0.24 ounce gold per ton. This includes a high–grade block of 319 000 tons with an average grade of 0.4 ounce gold per ton. Results from underground development indicated that the grade of the orebody is significantly higher than originally estimated from diamond drilling.

A 600 ton per day mill is to be completed by the first quarter of 1989. The mill will be expandable to 800 tons per day with a possible upgrade to 1000 to 1200 tons per day at a later date. A thirty mile long hydroelectric power line is being constructed from Highway 17 north of Wawa, to access the hydroelectric generator being constructed at Steephill Falls by Great Lakes Power. The power line is expected to be completed by the end of 1988. The company expects to have a pre–production workforce of about 110 and a production workforce of about 125.

A spiral decline currently provides access to five levels spaced at approximately 100–foot intervals, with extensive lateral work on four levels. Underground development drilling is adding to the ore reserve, with significant intersection of the Main and South zones occurring at the 350–foot level. A deep–drilling program, begun in the fall, is expected to test the orebody between 1000 and 2000 feet below surface.

In 1988, Echo Bay Mines Limited obtained a 21 percent interest in Muscocho Explorations Limited, leaving Flanagan McAdam Resources Inc. with 23.1 percent and McNellen Resources Inc. with 27.1 percent.

GRANGES EXPLORATION LIMITED

Granges Exploration Limited, in joint venture with MacMillan Energy Corporation, carried out a $4.5 million program on their land holdings in the Mishibishu Lake area. Of the six identified gold–bearing zones on their property, the Mishi Main zone has proven to be the most significant to date, with an estimated ore reserve of 1.106 million tons grading 0.166 ounce gold per ton. The Main zone lies about 2 km west of, and on strike with, the Magnacon gold deposit.

During late summer and fall, the surface exposure of the Mishi Main zone was stripped and sampled, outlining a mineralized area over 500 m long. Diamond drilling at 12.5 m spacings indicated continuity of gold mineralization over a 70 m depth and a width ranging from 3 to 5 m at an average grade of 0.15 ounce gold per ton. Gold mineralization is associated with minor pyrite and occurs in grey quartz veins within a quartz–sericite–chlorite mylonitic schist.

A 1 km road from the Magnacon road was completed in order to access both the Main zone and the new surface discovery. This was followed by a 6000–ton bulk–sampling program in the fall in order to determine whether there was an upgrading effect similar to that found in the Magnacon Mine. Granges Exploration Limited and Muscocho Explorations Limited have also agreed to test–mill up to 200 tons per day of openpit ore from the Mishi Project at the Magnacon mill, once it becomes operational in 1989.

Approximately 15 000 m of diamond drilling was completed on the Main zone and an addition of 3000 m on other occurrences. Two additional occurrences were discovered during the year, the Granges Glory and the White Swan, to the west of the Main zone. Plans for next year are to continue exploration and delineation drilling of the known deposits to prove up additional reserves, and to initiate a major exploration program on the eastern portion of the property.

HEMLO GOLD MINES INC.-CENTRAL CRUDE LTD.

Noranda Exploration Company, Limited, manager of the project, discovered a significant zone of gold mineralization early in the year on the Eagle River Property, located 10 km south of Mishibishu Lake. By fall, drill–indicated reserves were estimated at 960 000 tons at 0.27 ounce gold per ton based on 120 diamond–drill holes over a 6000–foot strike length and to a depth of 1000 feet (The Northern Miner, September 12, 1988). A 20 km road has been constructed south from Mishibishu Lake to access the property.

Free gold and minor amounts of sulphide minerals (pyrite, chalcopyrite, galena, and pyrrhotite) occur in large quartz veins contained within sheared diorite (quartz–feldspar–sericite–chlorite schist). The ore is characterized by a pronounced "nugget effect" which makes ore–reserve calculation difficult. Several mineralized quartz pods have been identified: No. 7, No. 8, and the Bruce vein. The No. 8 represents two pods of quartz, from less than 5 m up to 10 m wide, plunging steeply to the east over a length of about 1000 feet. The Bruce vein represents a single pod of similar size. The vein systems appear to be distributed *en echelon* and overlapping. Bulk sampling has been initiated, and detailed pre–feasibility studies are being considered. Diamond drilling for 1988 amounted to over 50 000 m.

EXPLORATION ACTIVITY

MISHIBISHU LAKE AREA

Muscocho Explorations Limited is continuing surface exploration on the former Westfield Property to the east of the Magnacon Mine. Activity focused on the Discovery, Hollinger, and Northwest occurrences with particular attention being paid to the Discovery Occurrence. All three gold occurrences are now accessible by road.

At the Discovery Occurrence, gold mineralization occurs in quartz veins which form parallel to the shear fabric within felsic schists. The sheared rocks and mineralized quartz veins are broadly folded and intruded by a diabase dike. The portions of the quartz veins adjacent to the dike have significantly higher gold values than elsewhere (Heather 1986). Both the dike and the mineralized zone are truncated by a northeast–trending fault which appears to have dislaced both the dike and mineralized zone to the southwest (the Hollinger Occurrence).

Granges Exploration Limited completed a 50 000–foot drill program designed to explore the Main, West, and KK zones. Two new gold occurrences were discovered this past year: the Granges Glory, and the White Swan. Another three mineralized zones occur in the eastern section of the property. A road has been constructed westward from the Magnacon road to access the Main zone for bulk–sampling purposes (*see* Advanced Exploration and Development section). Plans for next year include a greater emphasis on exploration on the eastern portion of their large land holding, and to establish the tonnage potential of the known occurrences.

The Applegath Group of companies (Allota, Oneida, Tundra, and New Beginnings) were active in the Mishibishu Lake and Dog Lake areas during 1988. Late in the fall, New Beginnings Resources Inc. (Tundra Gold Mines Ltd., operator) intersected a zone of gold mineralization assaying 2.77 ounces gold per ton over a 5–foot interval in the Dog (University) River area (University River Project). The mineralized zone occurs in a "quartz–flooded" metasediment containing banded pyrite and pyrrhotite. The zone is associated with a strong lineament and coincident gold and arsenic geochemical anomalies (1860 ppb gold; New Beginnings Resourced Inc., News Release, November 2, 1988).

Alotta Resources Ltd. (Tundra Gold Mines Ltd., operator) carried out a drilling program in order to evaluate several geochemical anomalies and surface showings in the Dog (University) River area. Grab samples of up to 0.4 ounce gold per ton were taken from arsenopyrite–bearing quartz veins within the Mishibishu Lake deformation zone. The "Glider zone" and "Chuckles zone" are magnetite–rich iron formations which are mineralized with arsenopyrite and pyrrhotite. Drilling this past year focused on a wide, northwest–trending quartz vein several kilometres in length.

The Oneida Resources Inc. (Tundra Gold Mines Ltd., operator) property is located west of the Noranda Inc.–Central Crude Ltd., Eagle River discovery. During the year, the company drilled a number of veins, sulphide zones, and shear zones, the most significant of which was the "Peek–a–Boo" vein. Drill intersections of the quartz vein indicate grades of up to 0.432 ounce gold per ton over two feet. Additional exploration is planned on an east–trending linear zone which extends from the Central Crude Ltd. Property into the Oneida Resources Inc. Property.

Tundra Gold Mines Limited was active west of Iron Lake, which is situated north of Mishibishu Lake in the western arm of the Michipicoten greenstone belt. Tundra Gold Mines Ltd. uncovered a wide deformation zone which appears to be the western continuation of the Iron Lake deformation zone, defined by Reilly (1988b). Tundra has outlined three settings for gold mineralization in this area: a) quartz–gold stockworks in diorite sills within a sericite–carbonate schist (grab samples assayed 0.2 to 0.6 ounce gold per ton); b) shear–zone–hosted quartz–carbonate veins along volcanic–sediment contacts (grab samples of the "Brown Vein" ran 0.22 ounce gold per ton); c) sulphide–facies iron–formation–hosted gold mineralization (The Northern Miner, September 19, 1988).

A number of quartz veins and stockworks occur within the 1200 foot wide deformation zone, which extends over a known distance of 2400 feet.

Tundra Gold Mines Limited staked two internal granitic batholiths east and west of the Noranda Inc.–Central Crude Ltd. discovery south of Mishibishu Lake, as well as portions of the external granitoids adjacent to the greenstone belt. Prospecting and drilling programs were completed during the summer.

The Windarra Group of companies had a number of active grass–roots exploration programs underway throughout the Mishibishu Lake area.

WAWA-MICHIPICOTEN AREA

Citadel Gold Mines Inc. continued surface stripping of gold–bearing quartz veins and shear zones in the Parkhill and Minto mines area (past producers). A new mineralized surface zone (the Root Vein) was uncovered north of Highway 101. The gold–bearing quartz vein is exposed over a distance of about 100 m and bulges up to 1 m in width. Citadel Gold Mines Inc. plans to follow up the surface work with a drilling program during the winter of 1988–1989.

Citadel Gold Mines Inc. completed a detailed surface–sampling program on the Cooper and Ganley veins which resulted in a better definition of the mineralized zones, and an upgrading of the gold assays. The upgrading of the gold assays apparently is due to the larger sample size together with a more homogeneous distribution of particulate gold in the veins rather than a nugget effect.

Citadel Gold Mines Inc. geologists are also reviewing gold occurrences and deposits on the property with the view to ascertaining the geological and structural controls on gold mineralization. Many of the gold–bearing quartz veins have been structurally deformed and disrupted making them difficult to delineate and mine. The two main orientations of gold–bearing structures are the north–trending Jubilee shear zone and the east–trending vein systems such as the Root Vein, Cooper, and Ganley veins.

FinNeth Exploration Inc. completed eight diamond–drill holes on the Ranson Prospect (Bridget Lake Resources Inc.) and has sampled the adit vein underground. FinNeth Exploration Inc. concluded that 10 000 to 30 000 tons of ore at 0.2 to 0.6 ounce gold per ton were available in the adit vein over a 800–foot strike length. Additional ore is reported from other veins on the property.

Longreach Resources Ltd. prospected and mapped a group of nine townships leased from the Algoma Central Railway (Operation Transgold). They concentrated on a section of greenstone belt south of the Michipicoten River, along the southeastern strike extension of the Monk gold mine.

Soocana Explorations Limited is continuing surface exploration of two gold occurrences north of Hawk Junction. The most advanced is the Blacksmith vein which has been exposed over a distance of 1000 feet, and consists of quartz veins within sheared quartz–feldspar porphyry and mafic metavolcanics. Drill intersections of up to 0.284 ounce gold per ton over 8.7 feet have been encountered. The Murray–Algom vein system is exposed over an area 300 feet long by 100 feet wide consisting of irregular, flat–lying quartz veins. Drill intersections of up to 0.436 ounce gold per ton over 6 feet have been encountered. Over 30 drill holes have been completed for both gold occurrences.

Reed Lake Exploration Limited is conducting a drill program on the Holdsworth pyrite zone, north of Hawk Juction, to test for gold mineralization observed in surface sampling.

Hillside Exploration Limited has completed stripping and initial diamond–drilling programs on the Hill Top Prospect south of Wawa Lake and Highway 101.

Van Ollie Exploration Limited is working on the past–producing Van Sickle Property, including the high–grade Sunrise, Wilcox, and Lucky Strike vein prospects. The property is on what appears to be an on–strike extension of the Parkhill Mine vein system. Multi–ounce assays have been obtained from surface trenches. Stripping and mapping are in progress.

Halley Resources Limited is conducting surface exploration in the vicinity of the Norwalk Mine (a past producer), south of Wawa. A drilling program began in late 1988. Further work is planned for 1989.

GOUDREAU-LOCHALSH AREA

Ego Resources Limited continues to be active around the Gutcher Lake stock, southwest of Goudreau. Since October 1987, they have completed 30 000 feet of diamond drilling and completed geology and induced polarization surveys. The gold–bearing zone is located between two previously developed ore zones, and has been traced 800 feet along strike and 600 feet downdip. The zone is open at depth and will be tested with an additional 10 000–foot drilling program. Gold mineralization is associated with pyrite and chalcopyrite in a sheared porphyry intrusive. Values range from 1.2 ounces gold per ton over 1 foot to 0.12 ounce gold per ton over 19 feet (The Northern Miner, February 15, 1988).

Tusk Minerals Inc. and Kowkash Gold Corp. completed a drilling program on the Old Cabin Lake gold prospect in Jacobson Township. Diamond–drill targets are based on results from geological and geophysical surveys, as well as known gold occurrences in the area.

Cline Development Corporation (Noranda Exploration Company, Limited, operator) completed a wintertime–scheduled (1987–1988) drilling program resulting in drill intersections of up to 0.155 ounce gold per ton over 15 feet on the Lake zone of their Jacobson Township prospect. Noranda Exploration Company, Limited is continuing to strip the area around the old Cline Mine in order to better understand the nature of the structures which control gold mineralization in the area. Further stripping on the Lake zone has uncovered a new set of northwest–trending, gold–bearing quartz veins which previously had not been identified. A drilling program was initiated to test areas around the old mine workings resulting in intersections of up to 0.585 ounce gold per ton over 5 feet.

Spirit Lake Exploration Limited completed 33 diamond–drill holes to evaluate two vein systems at the Edwards Mine (past producer) in eastern Finan Township. The prospect is believed to occur on the on–strike extension, or a splay, of the Goudreau Lake shear zone, which hosts the Magino Mine and Canamax Resources Incorporated's Lochalsh and Island gold zones. A major shear zone, up to 100 feet wide, has been exposed over about an 800–foot east–trending strike length, i.e., in the direction of Canamax Resources Incorporated's property. They are continuing a surface exploration program of stripping and an additional 30 000 feet of diamond drilling.

Golden Myra Explorations Limited is also active in eastern Finan Township with a program of surface exploration and diamond drilling. The claim group is less than one mile east of the Kremzar Mine, and contains the Michael Prospect which was explored in the mid–1930s. The property also covers the eastern extension of the Goudreau Lake shear zone on which Canamax has made two new discoveries. A 15 000–foot drill program is planned. Surface sampling has returned assays of up to 0.367 ounce gold per ton (The Northern Miner, July 18, 1988).

MISSANABIE-RENABIE AREA

Tundra Gold Mines Limited has completed a 2000–foot diamond–drill program west of Missanabie. Drilling of elctromagnetic anomalies indicated the presence of a chlorite–talc shear zone.

Ateba Mines Limited completed a 5000–foot diamond–drilling program on their Stover Township claim group. Initial exploration consisted of the stripping and sampling of two new mineralized veins occurring in sheared granitic rocks of the large internal plutons in the area. The presence of gold–bearing quartz veins within internal granites opens up new exploration targets for this region.

Canreos Minerals (1980) Limited is increasing its property interests in the Missinabie area by acquiring a 50 percent interest in 55 claims from Armistice Resources Limited, and a 50 percent interest in 30 claims from Conquest Yellowknife Resources Limited, in Riggs Township. Canreos Minerals (1980) Limited conducted geochemical and geophysical surveys in the spring followed by a 10 000–foot diamond–drilling program. The property is located on the on–strike extension of the Goudreau Lake deformation zone.

Conquest Yellowknife Resources Limited completed drilling and bedrock–stripping programs on their Smith Lake claims, located northwest of the Renabie Gold Mine.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Client services provided by the Wawa Resident Geologist's Office increased significantly during 1988 as compared to 1987 (*see* Figures 10.5 and 10.6). Office visits by the public more than doubled in 1988.

The fourfold increase in the publication sales figure from 1987 to 1988 is due to the establishment of the Wawa office as a sales outlet in September 1987. B. Leschishin and W. Wing are cash–receiving agents and were responsible for sales. In addition, B. Leschishin provided the Resident Geologist with capable administrative assistance throughout the year and assisted other staff members with preparations for the annual geoscience seminars.

The Resident Geologist spent 60 percent of the time involved in the administration and management of the office, as well as supervising four projects initiated in 1987, and one in 1988, under the Wawa Economic Development Initiatives program financed by the Northern Development Fund. In addition, the Resident Geologist visited 20 active properties undergoing surface exploration or underground development; attended nine field trips and two geological workshops; and held four regional tours and two local tours of exploration and development activity in the Resident Geologist's District.

Public addresses concerning exploration and development activity in the Wawa area were presented at a Ministry of Natural Resources Staff Day in Wawa, at the annual Small Business Week Seminar in Wawa, and at the annual Ontario Mines and Minerals Symposium held in Toronto. Technical presentations on the geology and mineral deposits of the Wawa area were made at the Renabie Geological Workshop, and at a Prospectors and Developers Association Meeting in Sault Ste. Marie. The Resident Geologist was asked to represent the Ministry of Northern Development and Mines at the official opening of Muscocho Explorations Limited's Magino Mine. A poster presentation entitled "Exploration and Development Activities in the Wawa District" was given at the annual Ontario Mines and Minerals Symposium in Toronto.

The Resident Geologist was a member of a Project Steering Committee which was responsible for a Mines Impact and Opportunities Study carried out for the Township of Michipicoten and the Improvement District of Dubreuilville by the Coopers and Lybrand Consulting Group. The Resident Geologist is also a member of, and provides technical support to, a regional interministerial development committee for the Wawa District. This provincial working group, composed of representatives from various ministries, is involved in co–ordinating regional development in the area by acting on the concerns of mining or exploration companies and affected communities, concerning such issues as road access, environment, and housing.

The primary activities of the Staff Geologist consisted of providing information and technical advice on request to prospectors and geologists from the exploration, academic, and government communities, as well as to the general public. The Staff Geologist responded to 620 geoservice requests, conducted 27 organized and impromptu field trips, and visited 16 exploration or mining projects. Geological education and mineral exploration awareness were promoted in the community by making presentations to a Ministry of Natural Resources Junior Ranger camp, to provincial park interpretative staff, to a Career Day for elementary school students in Grades Four through Eight, and with a field trip for a Grade 11 geology class.

The Staff Geologist continued to work with R.C. Stewart on improvement and expansion of the microcomputer data base of mineral deposits in the Wawa Resident Geologist's District (*see* project report in a later section). They also exhibited a poster on the "Wawa District Mineral Deposits Database"

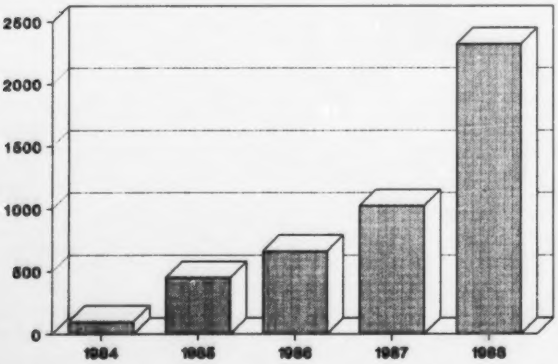


Figure 10.5. *Client services—number of visitors, 1984–1988.*

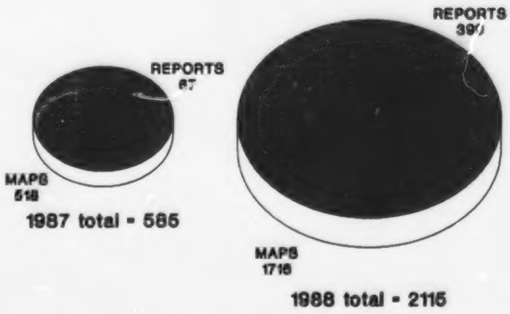


Figure 10.6. *Publication sales, 1987–1988.*

at the annual Ontario Mines and Minerals Symposium in Toronto, and at the annual Geoscience Seminar in Timmins.

Two geological workshops and field trips, sponsored by Renabie Gold Mines Limited and Citadel Gold Mines Incorporated, were attended during the year. In addition, the Staff Geologist was a member of a Technical Advisory Subcommittee involved in reviewing a Mines Impact and Opportunities Study for the Township of Michipicoten and the Improvement District of Dubreuilville.

A.C. Wilson continued to evaluate the granitic and gneissic terranes in the Wawa Resident Geologist's District. Her field program in the Kabinakagami, Oba, and Esnagi lakes areas consisted of recording both primary structural data and supplementary lithological data to augment the mapping of Siragusa (1973a, 1973b). She was assisted by I. Martin during the field season. A poster entitled "Mapping in the Wawa Area—An Update", was presented at the annual Ontario Mines and Minerals Symposium in Toronto. In addition, local field trips were organized for the Michipicoten High School geology class, and for prospectors interested in building stone. A series of geological "rock walks" were held during the summer months at Lake Superior Provincial Park. Evening programs on a variety of geological topics were also presented to the public at both Lake Superior Provincial Park and White Lake Provincial Park.

W. Wing supervised the updating of Geological Data Inventory Folios (GDIFs) carried out by P. Beach and C. Verville during the last half of 1988, and personally compiled and updated folios for areas of high exploration potential and activity. Exploration data submitted to the Resident Geologist's Office (i.e., assessment work reports, Ontario Mineral Exploration Program reports, etc.) were processed and indexed to the assessment files and entered into computer data bases with the assistance of C. Verville. A poster was presented at the Ontario Mines and Minerals Symposium on "Geological Data Inventory Folios". In addition, she provided assistance to prospectors, geologists, government staff, and the general public visiting the office, as well as with the sale of publications, claim maps, claim tags, and prospectors' licences.

L. Ashick continued the consolidation of exploration files from the Algoma Central Railway into the assessment files for the Wawa and Sault Ste. Marie Resident Geologists' offices. Assistance was provided to the Resident Geologist with the compilation of assessment information for the Wawa District. In addition, assistance was provided to E.J. Leahy (Staff Geologist, Sault Ste. Marie) with the development of a GDIF manual.

Both L. Ashick and W. Wing represented the Wawa Resident Geologist's Office on issues concerning the GDIF program and the computerization of assessment-file indices. Together with E.J. Leahy, they contributed to the development of a standard format for Geological Data Inventory Folios.

E. Haley assisted the Resident Geologist with the production of poster displays for the geoscience seminars, the compilation and drafting of geological maps, the compilation of information and drafting of Mines Impact maps for the Wawa Resident Geologist's District, and the compilation of property location maps for five active exploration areas in the Wawa District. P. Beach subsequently updated the property location maps and finished upgrading the data base. As well, P. Beach assisted the Resident Geologist with the updating of the Mines Impact maps and data base, and with the development of a flowchart indicating applicable Ministry permits for each stage of exploration through to mine development.

PROPERTY EXAMINATIONS

THE MONK PROSPECT (GOLD MONK RESOURCES INC.)

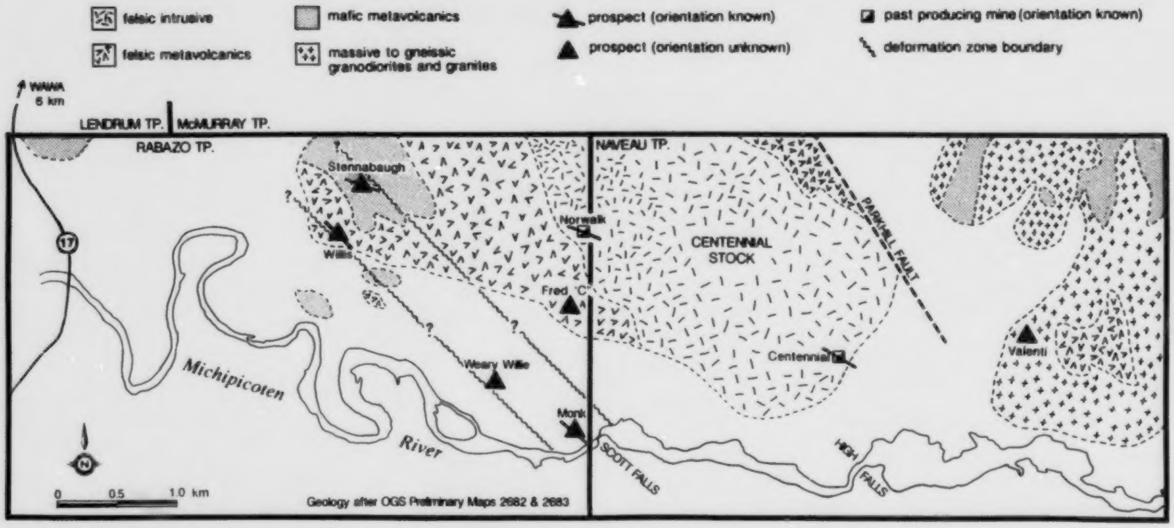
The Monk gold prospect is 10 km south of Wawa, near the eastern boundary of Rabazo Township, 300 m northwest of the Scott Falls Dam on the Michipicoten River. It is accessible by an all–weather gravel road from Highway 17. Total production from several bulk–sampling programs, since gold was discovered in 1936, has been less than 100 ounces. The last exploration program on the property ended in 1987, and the prospect is currently dormant (December 1988).

Gold mineralization is concentrated in a series of *en echelon* quartz veins which strike 050° and dip 45° northwest. Assays from early surface– and recent subsurface–sampling programs consistently yielded 0.5 ounce gold per ton. Tonnage calculations are not available.

The shallow–dipping, northeast–trending mineralized veins transect a zone of weakly mineralized quartz–carbonate veins (the "main zone") that are concordant with the regional southeast–striking foliation. The zone consists of a 3 to 4 m wide section of vertical quartz veins and stringers, which are contained within an intensely sericitized, carbonatized, and silicified host rock. The degree of alteration obscures host rock identification; however, property mapping suggests an intermediate to mafic volcanic assemblage.

The "main zone" and the associated shallow–dipping mineralized veins occur at the apparent southwestern margin of a regional zone of intense flattening strain, trending about 140° and dipping vertically. This zone of deformation is at least 335 m in width and over 3 km in length (*see* Figure 10.7).

Two additional gold occurrences are hosted by this relatively unexplored zone: the Willis Vein Prospect, and the Weary Willie Prospect. Further pros-


felsic intrusive
felsic metavolcanics
mafic metavolcanics
massive to gneissic granodiorites and granites
prospect (orientation known)
prospect (orientation unknown)
past producing mine (orientation known)
deformation zone boundary
WAWA 6 km
LENDRUM TP.
McMURRAY TP.
RABAZO TP.
NAVEAU TP.
17
Stennabaugh
Willis
Norwalk
Fred "C"
Weary Willie
Monk
CENTENNIAL STOCK
Centennial
PARKHILL FAULT
Valenti
Michipicoten
River
SCOTT FALLS
HIGH FALLS
N
0
0.5
1.0 km

Geology after OGS Preliminary Maps 2682 & 2683

Figure 10.7. *Gold mineralization—Michipicoten River area.*

pecting for gold is warranted for both the vertical– and shallow–dipping vein systems throughout the length and width of the high–strain zone.

HIAWATHA GOLD MINE (PAST PRODUCER)

The Hiawatha Prospect is in central Lizar Township, on the northwestern side of Picard's Point, Kabinakagami Lake (*see* Figure 10.9). The property has been dormant since its last surface and subsurface exploration in 1984. Gold was discovered in 1926 and developed in 1939, resulting in the production of 179 ounces of gold from a bulk sample of 1931 tons.

Native gold occurs in a sheared quartz vein, and in an adjacent quartz porphyry dike with intense sericite and carbonate alteration. The gold appears as fine grains within and adjacent to late quartz. Both the vein and dike strike at about 170°, dip vertically, and intrude pillowed mafic metavolcanics. Trench samples of the vein from near the shaft have yielded assay results of 0.346, 4.47, and 4.902 ounces gold per ton (Assessment Files, Wawa Resident Geologist's Office, Wawa).

Although narrow (5 to 25 cm), the quartz vein has a strike length of over 500 m, and the quartz porphyry (sericite schist) shear zone is part of a 4 km long deformation zone within a polymictic mafic breccia northeast of the mine site. The mafic metavolcanics are intensely foliated near the quartz porphyry contact, trending northeastward and dipping vertically. Mineral lineations are well developed near the mine site and plunge steeply to the northeast. These structural features and the known gold mineralization suggest the need for detailed prospecting along the entire length of the deformation zone.

RESEARCH BY RESIDENT GEOLOGIST'S OFFICE STAFF

WAWA DISTRICT MINERAL DEPOSIT DATA BASE

by E.D. Frey and R.C. Stewart

The Wawa District Mineral Deposits Data Base Project continued into its second year of development. The project objective is to develop and maintain a data base of geological, production, and geographical facts on the numerous gold and base–metal occurrences in the area, using a microcomputer–retrievable format. The project is supported by the Ministry of Northern Development and Mines' Northern Development Fund.

The data base uses dBase III Plus® and Relational Report Writer® software for storage, searching, and retrieval of facts on an individual or multifactor basis. When applied to a consolidation of mineral deposit data from older government reports, assessment files, recent Ontario Geological Survey mapping, and Wawa Office staff observations, these features provide: a) rapid access to data on specific occurrences; b) a means of exploring geological relationships among deposits; and c) identification of critical knowledge gaps, within individual deposits or the data base as a whole, which would direct further study.

The evolution of the present data base from published mineral deposit data bases has been detailed in Tortosa *et al.* (1988) (p.178, 180).

Work in 1988 focused on improving the retrieval format by using the greater flexibilty of Relational

Report Writer®, and expanding the contents of the data base. In addition, the data base had been enlarged from 68 records at the beginning of the year to over 370 records by year's end, comprising occurrences that range in significance from present– and past–producing orebodies to unexplored showings. These have been keyed to a 1:100 000 scale regional geological index map which is at the same scale as the recently released airborne geophysical survey for the Wawa area.

Consolidation and refinement of the data base structure has led to the reduction of the number of data–entry fields from 128 to 62. This was done, without loss of geological information, by the expanded use of memo fields and by the development of brief dictionary lists to standardize and facilitate data entry. These changes yielded a simplified screen format and greatly improved data base searchability.

Further work in 1989 will involve continued upgrading of the data base. In addition, P. Beach will begin developing a user–friendly menu, the production of graphical output for selected data, and the development of a more memory–efficient data base structure.

RECONNAISSANCE MAPPING–KABINAKAGAMI LAKE GREENSTONE BELT

by A.C. Wilson

Introduction

The program to evaluate the granitic terranes in the Wawa area continued during the 1988 field season. The focus of the program has shifted from its original intention of simply outlining areas of industrial–mineral and building–stone potential, to developing a more detailed understanding of the nature of the granites in the area. This shift in focus has largely resulted from the limited access available to building–stone developers in the Wawa Resident Geologist's District.

Field work during the summer of 1988 was concentrated in the Kabinakagami Lake area. Kabinakagami Lake is in the extreme northeastern portion of the Wawa Resident Geologist's District, and was chosen for examination because of the lack of information available about the granites. The greenstone belt segment outcropping in the area has also received renewed interest due to the presence of numerous mineral occurrences there. In particular, the presence of a past–producing gold mine (Hiawatha) has heightened exploration interest the area.

Outcrop exposure on the lakeshore is good, and provides a good overview of the geology. Due to time constraints, field work was restricted to lakeshore mapping. A study of aerial photographs indicates that outcrop exposure is poor inland, except in the vicinity of the Hiawatha gold mine which is situated on the western side of the lake.

The area was originally mapped, at a scale of 1 inch to 1/2 mile, by Siragusa and assistants (1973a, 1973b). Information collected during the 1988 field season is supplemental to Ontario Geological Survey Map 2355 (Siragusa 1977).

Funding for this program is provided through the Northern Ontario Regional Economic Development Fund (NOR–DEV), and assistance during the field season was provided by I. Martin. An Open File Report is scheduled to be released at a later date, containing the results of this supplemental mapping program and specific data concerning the granites in the Wawa Resident Geologist's District.

Location

Kabinakagami Lake is located approximately 100 km north–northeast of Wawa. The area covers four contiguous townships: Derry, Ermine, Lipton, and Lizar, for a total area of approximately 829 km^2 (*see* Figure 10.8).

Access to the area is by float–equipped aircraft from Wawa, or by private road from the community of Oba.

Geology

Current mapping in the Kabinakagami Lake greenstone belt has yielded a few fundamental changes in the lithologic units presented on previous geological maps (Siragusa 1973a, 1973b, 1977). These changes have arisen from the increased number of outcrops now visible due to lower water levels. In addition, more comprehensive structural data were collected to add to the original information.

Generally speaking, the map area consists of a northeast–trending metavolcanic–metasedimentary belt. Figure 10.9 shows a generalized geological sketch map of the area.

Mafic metavolcanic rocks are, volumetrically, the dominant lithology present in the central portions of the lake, and account for approximately 75 percent of the exposed lithology. These volcanic rocks are mostly massive to strongly foliated, and fine grained.

Few primary structures are preserved, except in those areas where the grade of metamorphism is lower than amphibolite, and where local deformation intensities are low. Pillowed mafic volcanics outcrop at the Hiawatha gold mine in central Lizar Township, and along the northern shore of the lake (Siragusa 1977).

The mafic fragmental unit, originally described by Siragusa (1977) has been traced northeastward along a series of rock shoals for an overall strike length of approximately 4 km. This fragmental unit is a polymictic breccia consisting of 75 to 80 percent subangular fragments in a mafic tuffaceous matrix.

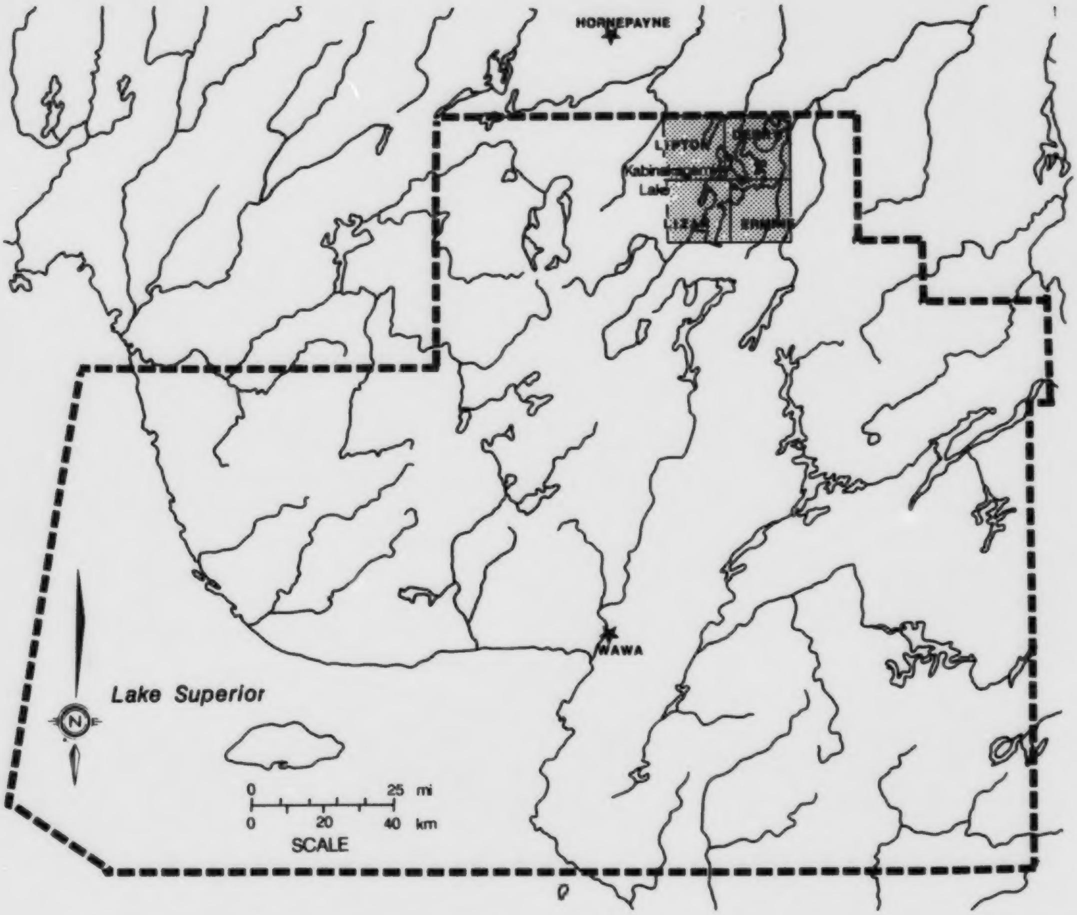


Figure 10.8. *Kabinakagami Lake mapping project — location map.*

The fragments are mostly felsic to intermediate in composition, although some medium-grained mafic volcanic and coarse-grained amphibolitic fragments also occur. Fragments range from 1 to 15 cm in length, with an average size range of 5 to 10 cm. This unit has been strongly deformed and is visibly recognized as the most intensely foliated unit in the map area. This unit may represent a narrow deformation zone trending northeastward.

Felsic volcanic rocks outcrop largely as narrow interbeds within the mafic volcanic rocks. These rocks are often quartz porphyritic, and are best exposed at the Hiawatha Mine, as well as along the southwestern side of the mine peninsula. A narrow band of felsic tuffs has been mapped to the southwest of the interlayered mafic–felsic unit. This unit was interpreted as sedimentary by Siragusa (1977).

Clastic metasediments are well exposed on the southeastern side of the lake. These rocks are composed of interbedded metasiltstones and metasandstones. No primary relict structures were observed in the metasediments. The southeastern metasedimentary–granite contact has been better defined as a result of current mapping (*see* Figure 10.9).

The intrusive rocks that were mapped were dominantly granodioritic to trondhjemitic in composition. Generally, the intrusions consist of moderately to strongly foliated biotite granodiorite to trondhjemite, which often support hornblende-rich xenoliths. Closer to the contact with the volcanic rocks, hornblende becomes an important mafic constituent of the granitoids. Siragusa (1977) has suggested time–space relationships which were unconfirmed by the current mapping.

Current mapping has also outlined two internal plutons. A small circular plug of massive diorite outcrops in a group of islands in northern Ermine Township. This rock is massive, homogenous, and equigranular, and occurs as a series of rounded hornblende-rich outcrops. The second internal pluton compositionally appears to be a hornblende

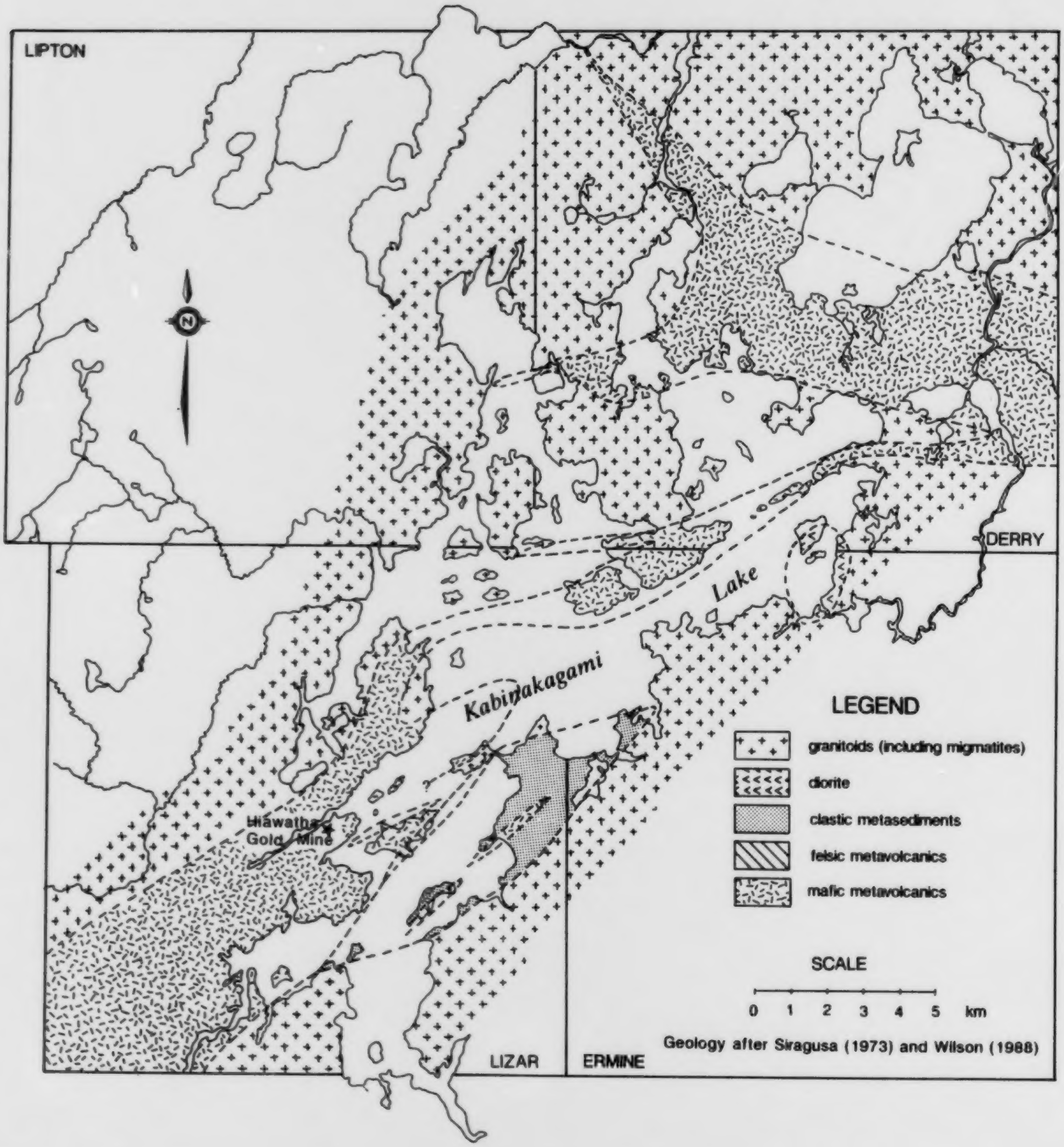

LIPTON
N
DERRY
Kabinakagami
Lake
Hiawatha Gold Mine
LIZAR
ERMINE
LEGEND
granitoids (including migmatites)
diorite
clastic metasediments
felsic metavolcanics
mafic metavolcanics
SCALE
0 1 2 3 4 5 km
Geology after Siragusa (1973) and Wilson (1988)

Figure 10.9. *Generalized geology of the Kabinakagami Lake area (after Siragusa 1977).*

granodiorite to quartz monzonite. This body outcrops in a line of islands in northwestern Ermine Township. This may represent a granitic sill.

All units are cut by a series of late, southeast-trending diabase dikes.

Metamorphic grade in the area is transitional between upper greenschist and lower amphibolite. The metamorphic gradient lies approximately along the synclinal axis projected by Siragusa (1977) (*see* Figure 10.10). To the northwest, the rocks are upper to middle greenschist grade and, to the southeast, lower to middle amphibolite grade.

Structural Geology

The metavolcanic rocks are generally strongly foliated with an overall northeasterly trend in the southwestern section of the map, and a roughly easterly trend in the northern portions of Lizar and Ermine townships. In most cases, the foliations are steeply

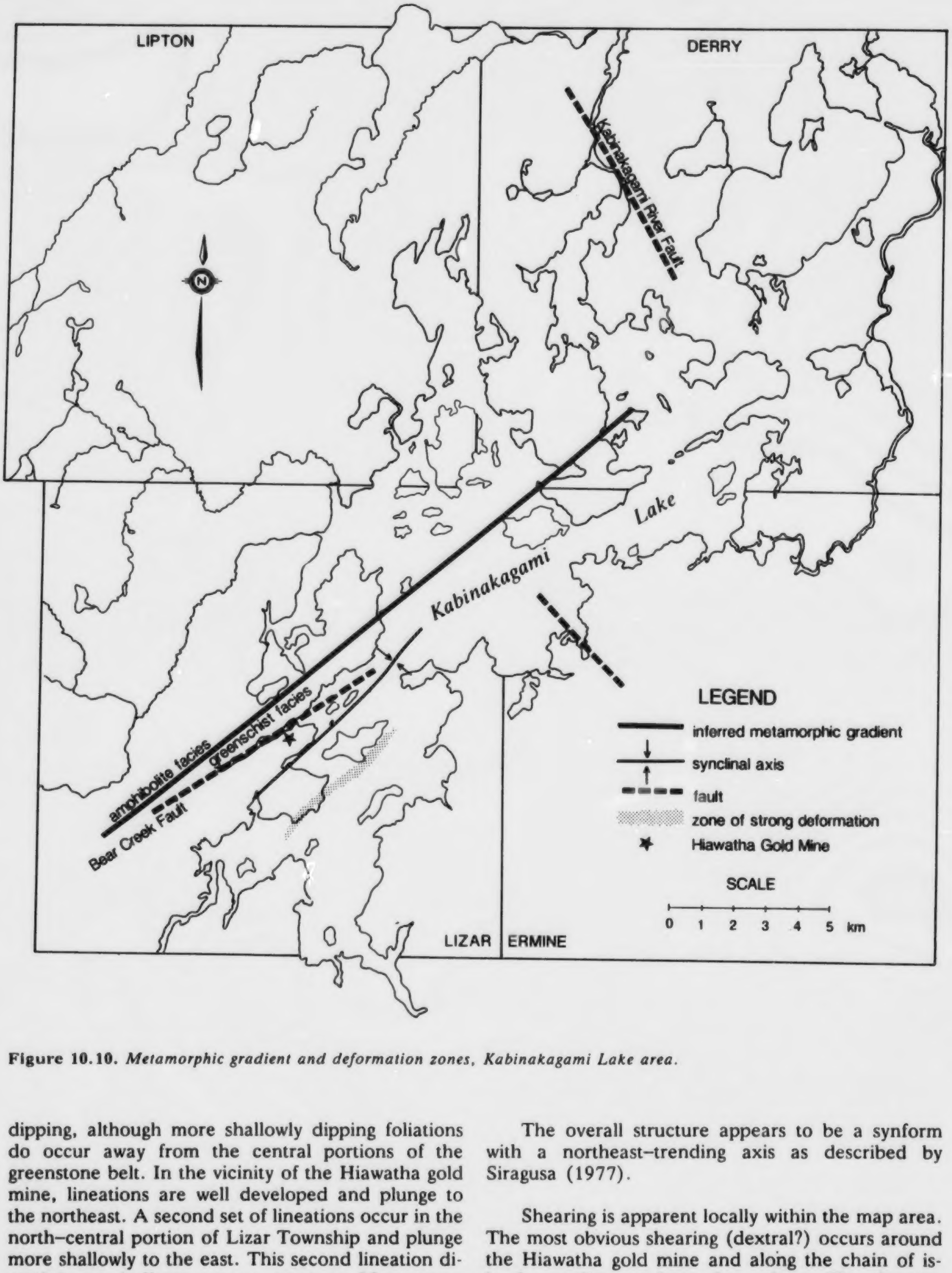

LIPTON
DERRY
LIZAR
ERMINE
N
Kabinakagami River Fault
Kabinakagami Lake
amphibolite facies
greenschist facies
Bear Creek Fault
LEGEND
inferred metamorphic gradient
synclinal axis
fault
zone of strong deformation
Hiawatha Gold Mine
SCALE
0 1 2 3 4 5 km

Figure 10.10. *Metamorphic gradient and deformation zones, Kabinakagami Lake area.*

dipping, although more shallowly dipping foliations do occur away from the central portions of the greenstone belt. In the vicinity of the Hiawatha gold mine, lineations are well developed and plunge to the northeast. A second set of lineations occur in the north–central portion of Lizar Township and plunge more shallowly to the east. This second lineation direction may indicate a cross structure. More structural data are needed to verify this interpretation.

The overall structure appears to be a synform with a northeast–trending axis as described by Siragusa (1977).

Shearing is apparent locally within the map area. The most obvious shearing (dextral?) occurs around the Hiawatha gold mine and along the chain of islands trending northeast from there. The shearing occupies a zone approximately 1 m wide in this vicinity, and is often accompanied by quartz–carbonate alteration. At the Hiawatha gold mine, the shear zone hosts a granodioritic to trondhjemitic sill. Parallel shears occur on the northern side of Bear Creek (northwest of the mine) and host minor gossan zones (*see* Figure 10.10).

Shear zones in the northern portions of Lizar, Ermine, and Lipton townships, trend more easterly, in keeping with the overall foliation trends. These shear zones are also interpreted as being dextral.

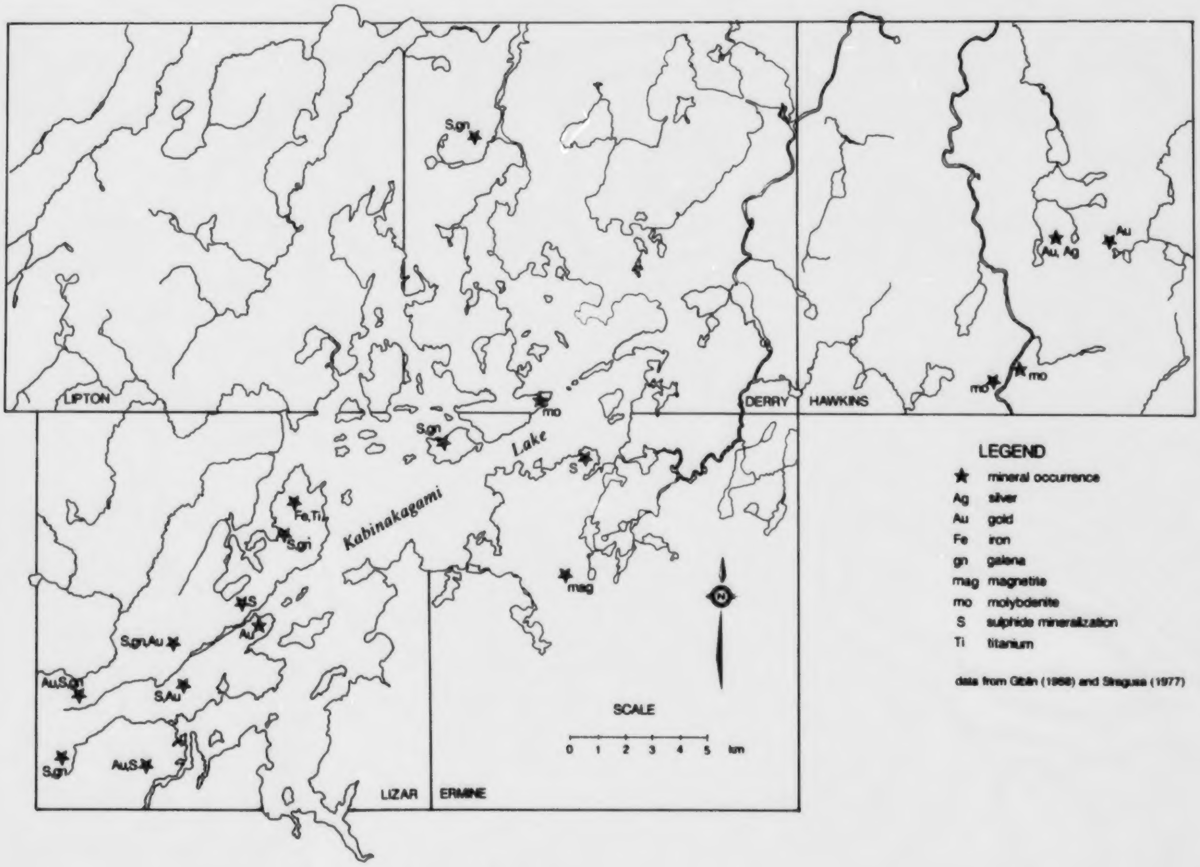
Fault zones in the area are restricted to the northeast-trending lineament along Bear Creek at the Hiawatha gold mine. Siragusa (1977) infers a second fault roughly parallel to the Bear Creek fault, at the southern end of Boot Bay. Several southeast-trending faults, with minor displacements, occur locally within the map area (Siragusa 1977).

Jointing is prominent within the granitic rocks in the map area. The major joint direction ranges between 340° and 020°. The secondary joint set, when developed, trends between 075° and 115°. Jointing is erratically developed throughout the map area but is better developed in the granitic rocks in the northern sections of the map area.

Economic Geology

Most of the known mineral occurrences in the map area occur within the mafic metavolcanic rocks which crop out in a central band trending northeast (*see* Figure 10.9). At the present time, exploration work is actively occurring within the belt. Mapping and geophysical programs are in progress to tie the Hiawatha gold mine, in central Lizar Township, with the Hawkins Township gold occurrences. Figure 10.11 shows the locations of the known mineral occurrences within Derry, Ermine, Hawkins, Lipton, and Lizar townships.

Gold was produced from the Hiawatha Mine in 1939. A total of 179 ounces of gold were produced from a 1931–ton bulk sample (Assessment Files, Resident Geologist's Office, Wawa.) Gold mineralization occurs in the granodioritic to trondhjemitic sill which occupies the shear zone at the mine. Mineralization is also known to occur in felsic units (quartz porphyry?) within the pillowed and massive mafic volcanics rocks.


LIPTON
DERRY
HAWKINS
LIZAR
ERMINE
Kabinakagami Lake
S,gn
Au, Ag
Au
mo
mo
mo
S,gn
S
Fe,Ti
S,gn
S
Au
mag
S,gn,Au
Au,S,gn
S,Au
S,gn
Au,S
SCALE
0 1 2 3 4 5 km
LEGEND
★ mineral occurrence
Ag silver
Au gold
Fe iron
gn galena
mag magnetite
mo molybdenite
S sulphide mineralization
Ti titanium

data from Giblin (1968) and Siragusa (1977)

Figure 10.11. *Mineral occurrences, Kabinakagami Lake area.*

The gold deposit occurs as a series of quartz veins in silicified and sericitized horizons in a sheared granodiorite to trondhjemite sill. This sill is not evident on surface at the mine site. Gold also occurs in a narrow, sheared quartz vein at the northern contact of a quartz porphyry within a felsic volcanic interbed.

This quartz porphyry and the associated vein are visible on surface. The quartz porphyry and associated carbonate-rich shear zone appear as an on-strike continuation along the chain of islands trending northeast from the mine (For additional details concerning this property, *see* Property Examinations section).

The critical factors that appear to be of importance to the gold mineralization in Lizar Township are the shearing (dextral) and silicification of the associated host lithologies. In addition, the gold occurrences appear to occur close to the inferred greenschist–amphibolite isograd. These factors should be considered by the prospector working in this area.

Gold–bearing quartz veins in mafic volcanic rocks, and gold–bearing quartz veins in biotite schist and aplite, occur in Hawkins Township, immediately to the east of the Kabinakagami Lake area. A total of 60 ounces of gold were produced from the quartz veins at the Shenango gold mine (Giblin 1968). No assay values are available for the Taylor Location, which lies immediately east of the Shenango gold mine. Both of these gold showings are approximately on strike with mineral occurrences in Derry Township. Time constraints and access problems did not allow a visit to these occurrences.

The remainder of the mineral occurrences within the map area are lead, zinc, and molybdenum occurrences (*see* Figure 10.11). No effort was made to locate old workings during the field season.

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM AND EXPLORATION DATA MANAGEMENT

by W. Wing

Compilation of Geological Data Inventory Folios, and updating of those previously compiled by the Sault Ste. Marie Resident Geologist's Office, continued in 1988, supported by NOR–DEV. Priority was given to areas with high exploration activity and(or) gold potential (*see* Figures 10.12, 10.13), and new information acquired for Algoma Central Railway townships (*see* Algoma Central Railway Exploration File Consolidation section).

Currently, 67 GDIFs are available for either viewing or purchase at the Wawa Resident Geologist's Office. Of these, 20 are available in published form, with the remaining unpublished GDIFs being offered for the cost of photocopying. Updates of Rennie, Macaskill, and Menzies townships, and the Mishibishu Lake area, as well as the initial compilation of Leeson Township were completed in 1988. To date, data for 31 percent of all townships in the area, and 65 percent of those with high gold potential have been compiled (*see* Figure 10.12). Computerization of the folios has greatly facilitated the storage and retrieval of data.

In 1988, 410 files were added to the Wawa Resident Geologist's library of exploration data. Townships with new assessment file information and available Geological Data Inventory Folios are indicated on Figure 10.13. A list of assessment files is available on request.

ALGOMA CENTRAL RAILWAY EXPLORATION FILE CONSOLIDATION

by L. Ashick

The consolidation of the mineral exploration files was initiated in order to allow prospectors, explora-

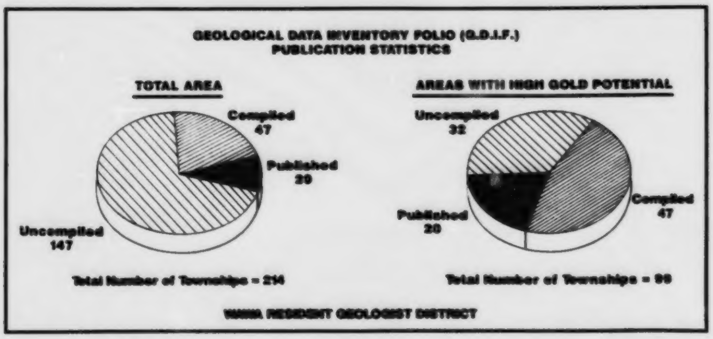


Figure 10.12. *Geological Data Inventory Folios, compilation statistics.*

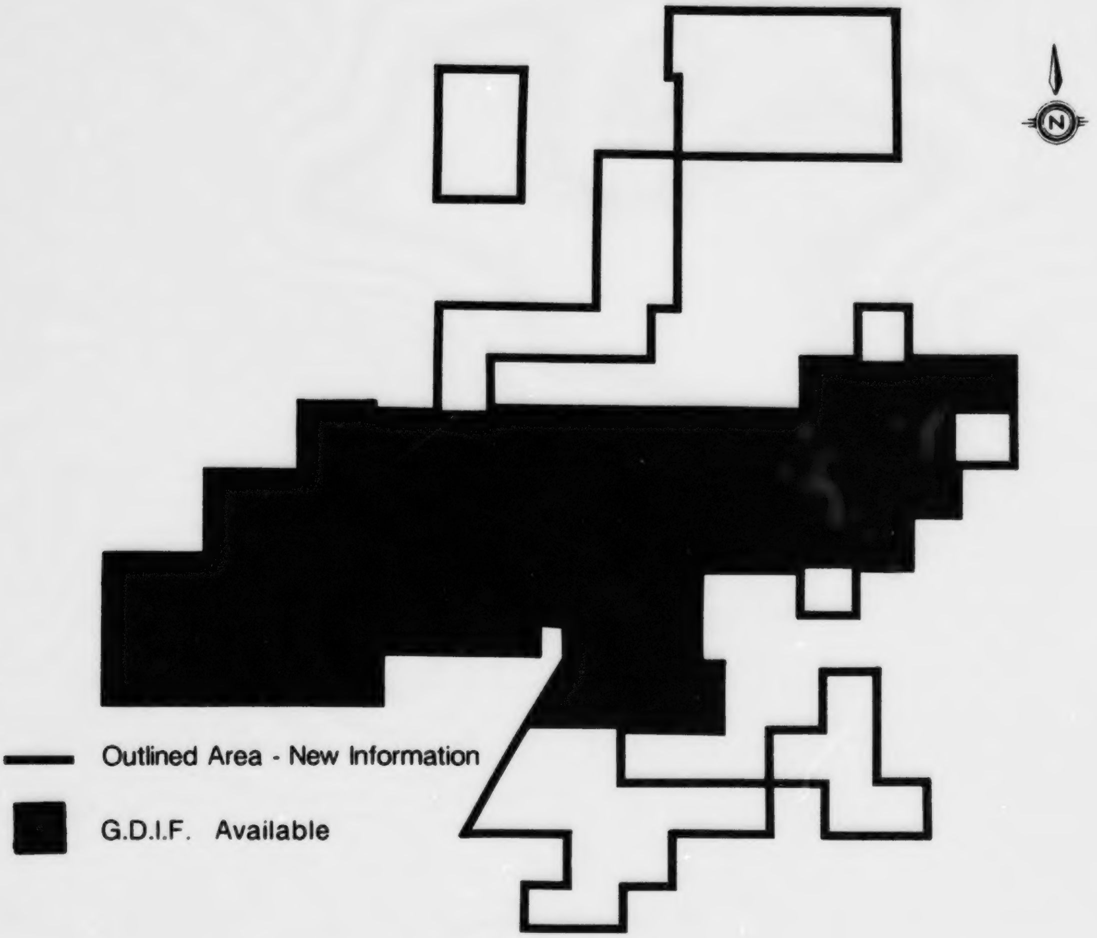


Figure 10.13. *New assessment files added to the Wawa Resident Geologist's files. Shaded areas indicate townships with compiled GDIFs; outlined areas indicate townships with new assessment files received in 1988.*

tion companies, and the public access to a complete and comprehensive library of assessment file information. The addition of this information to the Wawa Resident Geologist's Office also benefits the public by enabling them to find all the information available on a particular township or area, in one office. The project is supported by NOR–DEV and its main objectives are as follows:

1. To compile information in the Algoma Central Railway (A.C.R.) files that is missing from the Wawa assessment files and incorporate it into the assessment files
2. To compile Algoma Ore Division (A.O.D.) data that were previously unavailable to the public or missing from the Wawa assessment files, and incorporate it into the assessment files
3. To update published Geological Data Inventory Folios to include the new information obtained from the A.C.R., A.O.D., and recent assessment work that has been added to the Wawa assessment files

As of June 1988, all of the information that the Algoma Central Railway had on file had been compared with the Wawa assessment files, and copies of new information have been incorporated into the Wawa assessment files (*see* Figure 10.14). The new information has been assigned temporary file numbers in preparation for later production of microfiche, and assignment of permanent file numbers. Work areas pertaining to the new information have been outlined on township index plans, and new file numbers and vital information are now on a computer data base for easier retrieval and updating.

The new information obtained from the Algoma Central Railway covers 73 townships in the Wawa Resident Geologist's District, of which 19 are controlled by the A.C.R and the remainder by the Crown. Additional information collected over the years by R.P. Sage (Geologist, Precambrian Geology

Section, Ontario Geological Survey, Toronto), in mapping the Wawa area, is currently being consolidated into the assessment files.

The next stage of the project will be to update the respective Geological Data Inventory Folios for townships with high exploration activity or gold potential. At a later stage, new information will be entered onto microfiche in order to comply with the present filing system. In addition, plans are to be initiated, in 1989, for the consolidation of available Algoma Ore Division exploration data to be processed in the same manner as the Algoma Central Railway files.

ADDITIONAL PROJECTS

Two additional projects were initiated during the year and carried out by E. Haley and P. Beach.

The first involves the production of a mining or exploration property location map for each of the five main areas of activity in the Wawa Resident Geologist's District. These maps display geographical information on land status up to mid–1988. The maps are accompanied by a data base which summarizes the available information on each property (i.e., claim numbers, claim staker, company, etc.). Currently, the maps and data base are being used internally to allow the Resident Geologist's Office to keep track of exploration activity in the Wawa District.

The second project is in two parts. The first part consists of the production of a flowchart and data base indicating the required permits and applicable legislation at various stages of exploration and mine development. The flow chart of permit requirements will provide companies at various stages of exploration and development with a list of applicable legislation, required permits, and contact people from various government ministries.

The second part consists of the construction of an information map, with accompanying data base, showing the location of commercial fishing lodges, environmentally sensitive areas, potential hydro sites, sand and gravel quarries, etc. This type of map can be useful to an exploration company new to an area since it provides them with information on

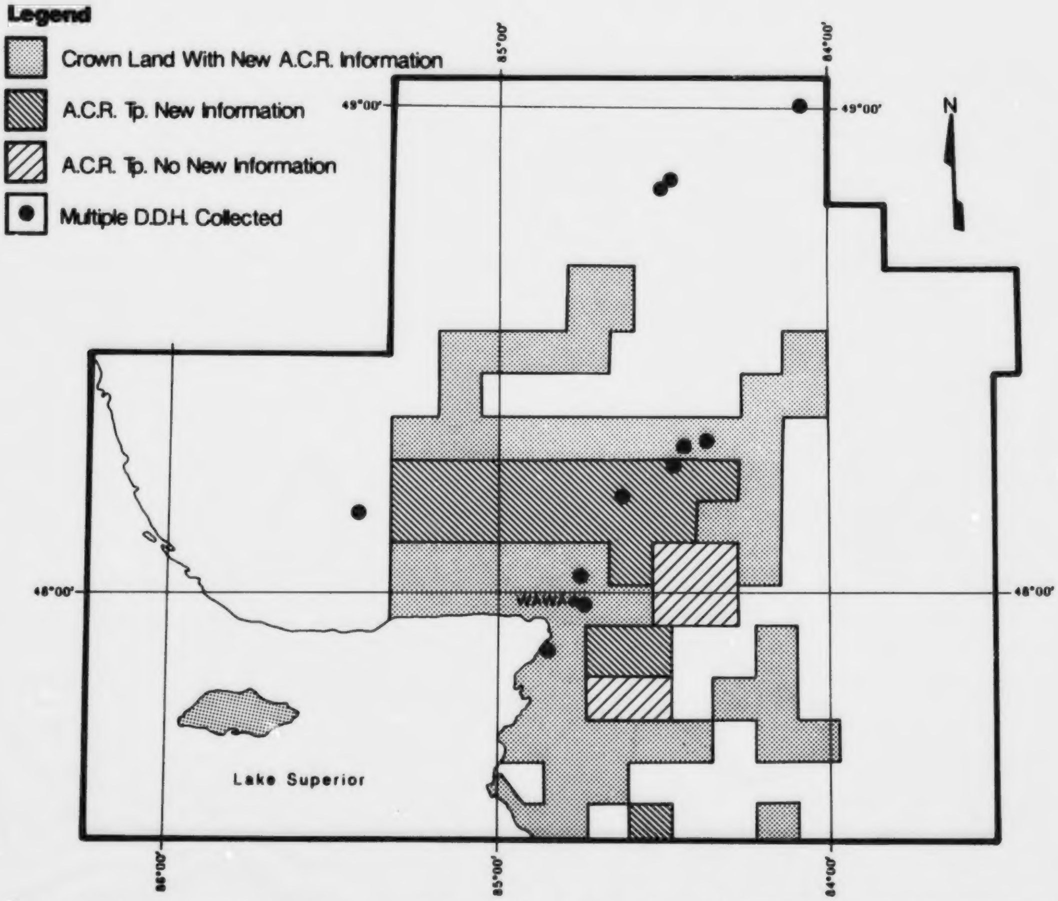

Legend
Crown Land With New A.C.R. Information
A.C.R. Tp. New Information
A.C.R. Tp. No New Information
Multiple D.D.H. Collected
85°00'
84°00'
49°00'
49°00'
N
48°00'
48°00'
WAWA
Lake Superior
86°00'
85°00'
84°00'

Figure 10.14. *Location map for Algoma Central Railway files consolidated in 1988; and for diamond–drill core collected in 1988.*

TABLE 10.3. DIAMOND-DRILL CORE COLLECTED FROM THE WAWA DISTRICT IN 1988.

COMPANY	TOWNSHIP/AREA
Canamax Resources Inc.	Finan
Citadel Gold Mines Inc.	McMurray
Cline Development Corp.	Jacobson
FinNeth Exploration Inc.	Rabazo
Golden Range Resources Inc.	Hawkins
McAdam Resources Inc.	Finan Abotossaway
Muscocho Resources Inc.	Finan
Nickel Rim Mines Ltd.	Lizar
Noranda Exploration Co., Ltd.	Chabanel
Owenbrook Resources Ltd.	Hawkins
Tanglewood Consolidated Resources Inc.	Lizar
Tundra Gold Mines Inc.	Abbie Lake

other activities which could produce potential conflicts.

DRILL CORE STORAGE PROGRAM

by J.D. Melisek

Staff for the Sault Ste. Marie Drill Core Library for 1988 included T. Pighin and D. Colletti as Experience '88 summer assistants, and J. Nichols, who worked on a three month co-op program affiliated with Alexander Henry High School. In July 1988, D. Messenger became Mining Claims Inspector and P. Morra became Drill Core Library Assistant as they exchanged positions on a six-month training assignment. J. Melisek remained in the position of Drill Core Library Geologist.

Activities for 1988 included the donation of core from 85 new holes from 13 different townships in the Sault Ste. Marie Mining Division. These new holes provided the library with an additional 9000 m of drill core, bringing the total stored in the facility to 79 000 m. The majority of the drilling received this year—7079 m—was from the Wawa Resident Geologist's District and the remainder from the Sault Ste. Marie Resident Geologist's District (*see* Figure 10.14, Table 10.3).

Major projects for 1988 included retrieval of type sections of drilling through the ore bodies of the new producers in the Wawa area. Contributions from Muscocho Explorations Limited's Magino Mine, Canamax Resources Incorporated's Kremzar Mine, and Citadel Gold Mines Incorporated's Surluga Mine are appreciated and will provide a permanent reference on the mine geology of these and similar properties for explorationists in the future. In addition, core from a number of drillholes was obtained from companies working on projects in the Goudreau–Lochalsh area; specifically, from Abotossaway, Finan, and Jacobson townships, with significant contributions from McAdam Resources Inc. and Cline Development Corporation.

Drill core from the old Hiawatha gold property, in the Bear Creek area of Kabinakagami Lake (northern Sault Ste. Marie Mining Division), has finally been placed in the core library. This core was only accessible by floatplane, but, with the assistance of the Wawa Resident Geologist's staff, it was eventually retrieved.

Fifteen drillholes totalling 721 m from two separate projects undertaken by Nickel Rim Mines Ltd. and Tanglewood Consolidated Resources Inc. were collected from Lizar Township. Upon further inspection, the drill core was observed to contain an abundance of mineralized quartz shear zones. A number of the holes were condensed due to aircraft space limitations; however, a good representation of the property's geology was preserved.

Other donations came from the townships just north and south of Wawa. Noranda Exploration Company's drilling of a carbonate-rich sequence in Chabanel Township, and eight holes put down by FinNeth Exploration Inc. on the Ransom Prospect (Bridget Lake Resources Inc.), in Rabazo Township, are now inventoried in the Drill Core Library.

The Mishibishu Lake area of the Sault Ste. Marie Mining Division is the scene of intense exploration, and many of the drill core storage facility's future plans involve the collection of drill core from this area. During 1988, we received drill core from eight holes on Tundra Gold Mines' Kabenung West Project. The eventual goal is to obtain drill core from the Magnacon Mine area similar to the collections made this year from other new producers in the mining division.

This past year has been the most encouraging so far, with increased use of the Drill Core Library and its inventory by government and industry personnel. For persons or companies wishing to donate core, or receive an inventory catalogue, please direct requests to the Wawa Resident Geologist's Office.

RECOMMENDATIONS FOR EXPLORATION

DEFORMATION ZONES AND GOLD EXPLORATION

The discovery of a significant gold deposit in the Mishibishu Lake area by Hemlo Gold Mines Incorporated, and by Central Crude Limited on their Eagle River Property, has encouraged the opening of the entire Mishibishu Lake greenstone belt for potential economic gold deposits. The gold discovery occurs within the Eagle River deformation zone, which trends approximately eastward and is about 1 km wide in the area of the discovery. The gold occurs in large pods of quartz contained within a discrete east–trending shear zone, cutting a lense-shaped diorite intrusion.

This discovery re-emphasises the importance of deformation zones within greenstone belts. To date, four deformation zones have been identified in the Mishibishu Lake area:

1. Mishibishu Lake deformation zone (MLDZ; Heather 1985, 1986)
2. Rook Lake shear zone (RLSZ; Bowen and Logothetis 1985)
3. Eagle River deformation zone (ERSZ; Bowen and Logothetis 1985)
4. Iron Lake deformation zone (ILDZ; Reilly 1988b)

In the Goudreau area, most gold deposits occur within the boundaries defined for the Goudreau Lake deformation zone (GLDZ; Heather and Arias 1987). Within the GLDZ are discrete shear zones (i.e., the Goudreau Lake shear zone) along which significant gold deposits have been discovered (Magino Mine, Muscocho Explorations Limited; Lochalsh–Island zones, Canamax Resources Incorporated; Goudreau zone, Canamax Resources Incorporated). The Goudreau Lake shear zone is characterized by a strong east–northeast–trending lineament which appears to bifurcate east of Goudreau Lake. These linear features can be easily observed on aerial photograph, radar, and Landsat images, and may reflect the expression of a fault or shear zone.

Several new deformation zones, which have the potential to host additional gold occurrences, have been defined in the Missanabie–Renabie area (Heather and Buck 1988). The Renabie orebody and several other gold deposits are related to similar shear zones which occur outside the greenstone belt, in the granitoid terrane. This implies that deformation zones, which transect internal or external granitoids, are viable exploration targets for gold exploration.

LITHOLOGY AND GOLD DEPOSITS

It is generally accepted that gold mineralization cannot be directly linked to one rock type, and that the formation of gold deposits hinges on the development of fluid conduits by the brittle to ductile deformation of the host rock. However, for many gold deposits and occurrences in the Michipicoten and Mishibishu Lake greenstone belts, the associated host rocks tend to be proportionally skewed toward felsic compositions; for example, the Surluga Mine (Jubilee Stock—diorite), the Magino Mine (Webb Lake Stock—trondhjemite), the Renabie Mine (tonalite, trondhjemite), and the Eagle River Deposit (diorite stock). Although structural conduits appear to be a necessary prerequisite for gold mineralization, the physical character of the host may ultimately decide how large these conduits will be.

For some gold deposits, it appears that felsic to intermediate granitoids provided a sufficient ductility contrast with the enclosing, layered metasedimentary and metavolcanic rocks, to result in rock failure, and consequently, preferential–channeling of fluids. Other rock types may also provide a suitable ductility contrast, as, for example, at the Kremzar Deposit which occurs within a massive metagabbro. The nature and character of the host rock then becomes an important consideration in property evaluation, property acquisition, and the design of an exploration program.

LATE FAULTING AND GOLD DEPOSITS

In the Mishibishu Lake area, late faulting can have a significant influence on the continuity of a gold–bearing zone. For example, in the area of the Granges–Muscocho properties (Mishibishu Lake deformation zone), late structural controls on gold mineralization consist of northwest– to northeast–trending faults with displacements ranging from a few metres up to 300 m. These faults are important in understanding the shape of an ore zone, particularly during the underground development and later mining stages of a deposit (Magnacon Mine).

As well, late faults may explain some of the geological and structural differences between some gold occurrences and deposits in an area. For example, in the Mishibishu Lake area geologists suspect that the Main zone (Granges Explorations Limited) may be the downfaulted and rotated continuation of the upper portion of the Magnacon Mine (Muscocho Explorations Limited) which lies 2 km along strike to the east, separated by the Macassa Creek fault. This then could have significant implications as to the depth extent of the Main zone and the ore grade. Another example is the Hollinger gold occurrence (Muscocho Explorations Limited) which may represent the western continuation of the Discovery gold occurrence (Muscocho Explorations Limited), displaced by a northeast–trending, late fault with an apparent 300 m of left–lateral movement.

In the Goudreau–Missanabie area, late, northwest–trending faults apparently offset wide deformation zones which host gold deposits (Heather and Buck 1988). Gold occurrences and deposits may occur where these faults transect the deformation zones (i.e., Goudreau Lake deformation zone) and are intruded by later diabase dikes (Heather and Arias 1987).

North of Hawk Junction, east–trending shear zones and lithologies are offset by apparent left–lateral movement along northwest–trending, late faults, and by the north–trending, regional–scale, McVeigh Creek fault. Some of the east–trending shear zones contain gold–bearing quartz veins with a similar orientation. Further exploration is warranted in areas underlain by the offset continuation of these mineralized structures (Tortosa *et al.* 1988).

OTHER USEFUL EXPLORATION TOOLS

A recent geochemical study of the lake sediments in the Goudreau area (Fortescue 1988) indicated the presence of several geochemical anomalies (molybdenum, copper, arsenic, lanthanum). Follow-up work using long-hole sediment cores resulted in verification of these anomalies; furthermore, samples covering the 9000 year sedimentation period show progressive increases in the concentration value of the anomalous element with depth (age). The molybdenum-copper lake-sediment anomaly occurs in a lake surrounded by granitoid terrane containing several molybdenite occurrences to the east, in the Hawk Junction area. Prospecting is warranted in the rocks surrounding the molybdenum lake-sediment anomaly and around other lakes with anomalous element concentrations (Fortescue 1988).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Wawa Resident Geologist's Staff provided assistance to the Ontario Geological Survey's field crews throughout the summer, assisting with logistics and in providing temporary geological assistance. The Ontario Geological Survey had five projects active in the Wawa area during 1988 (*see* Figure 10.1):

1. Geological mapping of the Iron Lake area, conducted by B.A. Reilly (Geologist, Precambrian Geology Section)
2. The development of an integrated geoscience database for the Goudreau area, by R.S. Mussakowski (Staff Scientist, Ontario Centre for Remote Sensing, Ministry of Natural Resources, Toronto) and N.F. Trowell (Geologist, Precambrian Geology Section)
3. Geological mapping of the Kabenung Lake area, conducted by R.P. Sage (Geologist, Precambrian Geology Section)
4. Geological and structural mapping of gold deposits in the Missanabie-Renabie area, by K.B. Heather and S. Buck (Geologists, Precambrian Geology Section)
5. Lake sediment and water geochemical surveys in the Goudreau area and south of Wawa (Rabazo Township) conducted by J.A.C. Fortescue (Geochemist, Geophysics/Geochemistry Section)

PRECAMBRIAN GEOLOGY SECTION

Ron Sage completed his final year of detailed mapping in the Wawa area with the completion of the geology of the Kabenung Lake area (Sage 1988a, 1988b). Geological maps at 1:15 840 have been completed for Lalibert, Knicely, and Killins townships. Spring and midsummer field trips were given for the Wawa and Goudreau areas, respectively. These field trips, having been held annually for seven years, have become a tradition, giving companies in the area the opportunity to discuss and compare geology, structure, and gold mineralization. This year the field trips attracted over 75 geologists.

Brian Reilly completed geological mapping at 1:15 840 in the Iron Lake area, covering Keating Township (Reilly 1988a, 1988b). A 300 m wide deformation zone was identified through the central part of Iron Lake. As well, discrete shear zones, up to 30 m wide, occur straddling the contact between metaconglomerates and metapelites-metapsammites. Similar deformation zones in the Mishibishu Lake area host major gold deposits.

A two-day field trip, reviewing the geology of the northwestern portion of the Michipicoten greenstone belt (Kabenung and Iron lakes area), was given by B.A. Reilly and R.P. Sage. Rocks previously mapped as metasedimentary have been remapped by Ron Sage as felsic volcanic and volcaniclastic rocks. Sage believes that these felsic volcanic sections may hold base-metal potential, which may be detected by the airborne geophysical survey of the area recently released by the Government of Ontario.

Kevin Heather continued a multiyear gold metallogenic and structural study in the Michipicoten and Mishibishu Lake greenstone belts. The 1988 field work by Heather and Buck concentrated on the Missanabie-Renabie area (Heather and Buck 1988). A field trip, held for industry and government geologists at the end of the field season, reviewed preliminary results of a study which indicates the presence of significant deformation zones in the area, many of which host gold occurrences.

R. Sage and B. Reilly led the Ontario Geological Survey's Archean Crustal Genesis Working Group on a field trip designed to review areas with problematic geology, and to assess the significance of Archean geological processes by drawing on comparisons with other parts of the central Superior shield.

The Ontario Geological Survey is working with the Ontario Centre for Remote Sensing (Ministry of Natural Resources) in order to develop a digitized geoscience data base which will provide new methods for interpreting and displaying available geological data (Mussakowski and Trowell 1988). The preliminary integrated maps will show radar, total magnetic intensity, and generalized geology on one map base.

GEOPHYSICS/GEOCHEMISTRY SECTION

J.A.C. Fortescue completed a detailed sampling program of the lake waters and sediments on Fin-Neth Exploration Inc.'s property (Ranson Occurrence) south of Wawa during the winter of 1988. This area has not been affected by fallout from the Algoma Ore Division's sintering plant, and can be used in evaluating the orientation surveys completed in the summer of 1987 in the Goudreau area. In addition, a lake-sediment and water survey of the western Goudreau area was completed in the fall, to supplement last year's survey. Long lake-sediment cores were also taken from lakes which gave anomalous element values in the 1987 survey; these anomalies were confirmed with a high degree of confidence.

An Airborne Geophysical Survey was released June 1, 1988, providing both electromagnetic and magnetic coverage of the Michipicoten and Mishibishu Lake greenstone belts. The release was well received by the exploration companies in the area, and coincided with an increase in claim-tag sales prior to release.

ENGINEERING AND TERRAIN SECTION

S. Szoke and G. Jones (Aggregate Assessment Office), completed a seismic survey of the Tremblay Flats area, west of Wawa, as part of an aggregate assessment for the Ministry of Natural Resources. The seismic survey and backhoe excavations at selected sites indicate that the high quality gravel exposed in operating pits does not have wide lateral extent. A decision is to be made by the Ministry of Natural Resources as to possible future use of the area for industrial development.

RESEARCH BY OTHER AGENCIES

The Ontario Centre for Remote Sensing (OCRS) sponsored an airborne radar survey of the Michipicoten geenstone belt. The survey was conducted within the RADARSAT program of the Canada Centre for Remote Sensing (CCRS). It has a resolution of 10 m by 20 m, and covers an area from Puskaskwa to east of Renabie, and from Old Woman Bay north to Goudreau. The OCRS has provided the Wawa Resident Geologist's Office with 1:250 000 scale prints showing radar imagery of the Wawa Resident Geologist's District. These images provide significant new regional structural information for the Wawa District.

M.H. Cohen (MSc candidate, Bowling Green State University, Bowling Green, Ohio) is completing a study of the petrography and paragenesis of the Helen Iron Formation, G.W. MacLeod Mine, Wawa.

T.A. Harding (MSc candidate, Bowling Green State University, Bowling Green, Ohio) began a study of the precious-metal geochemistry of the Helen Siderite, G.W. MacLeod Mine, Wawa.

Z.G. Arias (MSc candidate, Queen's University, Kingston) began field work southwest of Goudreau in her study of the tectonic evolution of the central and eastern part of the Michipicoten greenstone belt.

G.E. McGill (Professor, Department of Geology, University of Massachussetts-Amherst) continued structural studies in the central and northeastern part of Chabanel Township for a fifth season. He is developing a tectonic history of the south-central part of the Michipicoten greenstone belt.

C. Pare (BSc candidate, University of Windsor) is studying fluid inclusions of the surface quartz veins at the Parkhill, Minto, and Mariposa mines near Wawa.

ACKNOWLEDGMENTS

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11. Sault Ste. Marie Resident Geologist's District—1988

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INTRODUCTION

As in 1987, mineral exploration in the Sault Ste. Marie area focused on gold with most of the activity taking place in the Olsen, Palmer, and Wishart townships in the western part of the Batchawana metavolcanic–metasedimentary belt. The increasing prices of copper and zinc have led to renewed interest in base-metal exploration in the Sault Ste. Marie area.

MINING ACTIVITY

Denison Mines Limited continued production of uranium oxide from its mine and mill at Elliot Lake, where bacterial leach recovery is being successfully carried out in addition to conventional mining and recovery methods.

In early 1987, Denison Mines Limited purchased the mining leases of Canuc Resources Limited located on the south boundary of Denison's Elliot Lake property. Development headings were completed from Denison's underground workings to the Canuc property. A recently constructed conveyer belt will be used as part of the transportation system in the new mining area. Canuc Resources will receive a royalty of C$1.025 per pound of uranium oxide contained in broken ore. The royalty is subject to annual escalation (The Northern Miner, July 4, 1988).

Rio Algom Mines Limited continued operation of the Quirke, Stanleigh, and Panel mines in the Elliot Lake area. Rio Algom has approximately 2700 employees engaged in uranium mining in the Elliot Lake camp.

Location of producing mines is shown in Figure 11.1.

EXPLORATION ACTIVITY

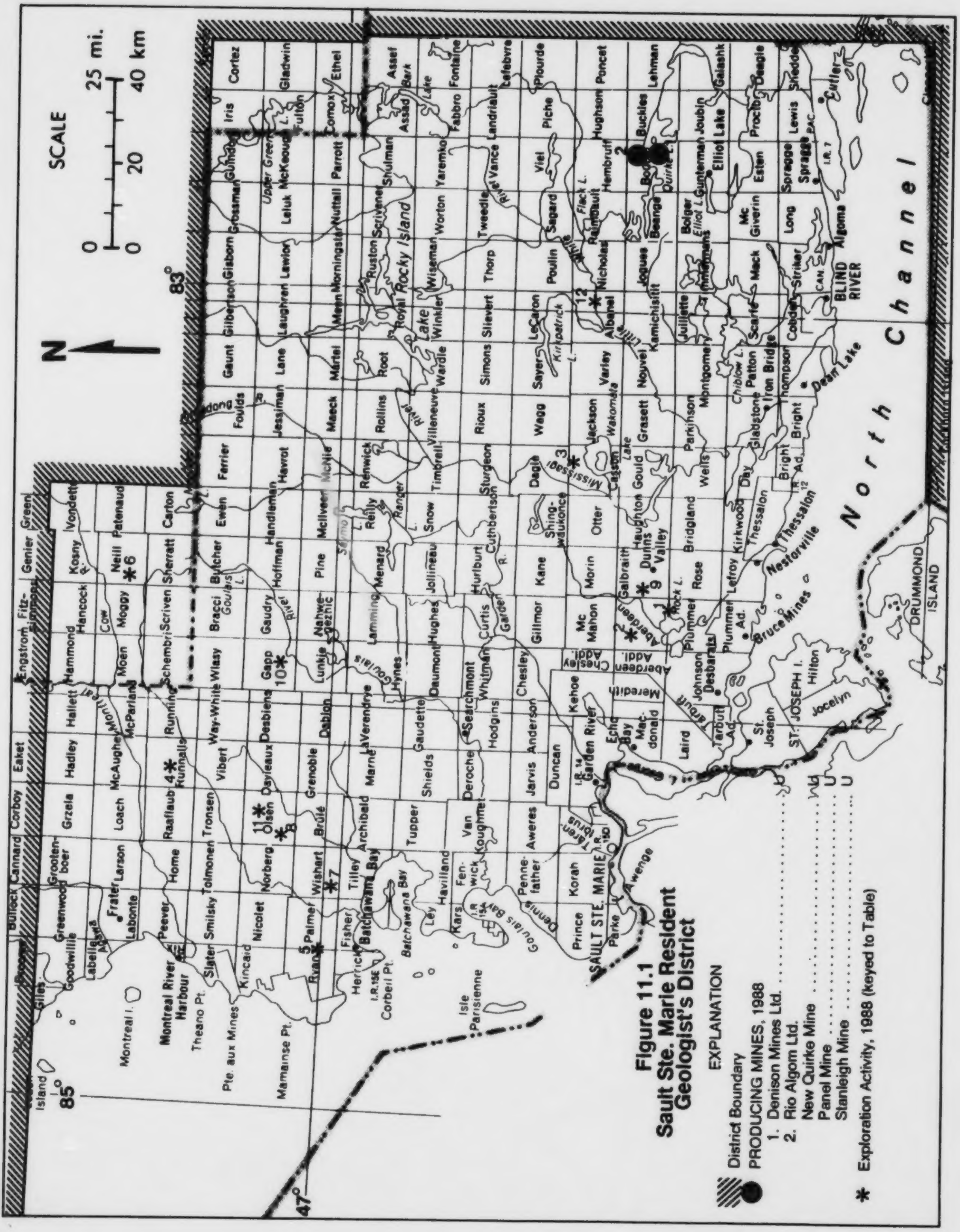
Mineral exploration in the Sault Ste. Marie Resident Geologist's District increased slightly over the 1987 level. The total number of claims recorded increased from 681 in 1987, to 881 (January 1 to November 17, 1988). The total man–days of assessment work submitted increased from 6959 to 8167 over a similar period.

Table 11.1 summarizes the exploration activity in the Sault Ste. Marie Resident Geologist's District during 1988.

Duration Mines Limited holds 66.6 percent and Aurogin Resources Limited holds 33.3 percent of a 498–claim group in Palmer and Ryan townships in the Batchawana area. Duration Mines Limited, which amalgamated with Locator Explorations Limited in June 1988, manages the property.

An airborne electromagnetic (EM), VLF–EM, and magnetic survey was completed over the property during the summer of 1988. A reconnaissance drilling program of 31 holes totalling 3000 m (10 000 feet) was completed by Duration Mines Limited in January and February 1988. Hole 3 intersected 6.5 m (21.3 feet) grading 0.055 ounce gold per ton, 0.97 ounce silver per ton, 2.6 percent copper, and 0.27 percent zinc. A 100 m (330 feet) interval of Hole 25 intersected widespread copper values ranging from 0.1 percent to 0.68 percent. Stripping and sampling over a strike length of 750 feet (230 m) was carried out on the gold–cobalt showing formerly held by Glenrock Gold Mines. Geological mapping, geochemical and ground VLF, and magnetic surveys of selected areas were carried out in the summer of 1988 (The Northern Miner, July 25, 1988; Annual Report for 1988 of Aurogin Resources Limited).

Wolverine Resources Incorporated of Sault Ste. Marie did prospecting, test pitting, and sampling on a 49–claim group in Gapp Township during the summer of 1988. The property has since been optioned to Noranda Exploration Company, Limited. In the late fall of 1988, Noranda did line cutting and power stripping over previously defined geophysical anomalies. Soil geochemical surveys and ground horizontal loop electromagnetic surveys were also carried out (P. Cooper, Project Geologist, Noranda Exploration Ltd., personal communication, 1988).


SCALE
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North Channel
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ST. JOSEPH I.
SAULT STE. MARIE
BLIND RIVER
Thessalon
Bruce Mines
Iron Bridge
Elliot Lake
Dean Lake
Nestorville
Desbarats
Echo Bay
Garden River
Cutler
Rocky Island Lake
Mississagi
Goulais R.
Batchawana Bay
Goulais Bay
Montreal I.
Montreal River Harbour
Theano Pt.
Pte. aux Mines
Mamainse Pt.
Corbeil Pt.
Isle Parisienne
Searchmont
Frater
Dunns Valley
1
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3
4
5
6
7
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11
12

Figure 11.1
Sault Ste. Marie Resident Geologist's District

EXPLANATION

▨ District Boundary

● PRODUCING MINES, 1988
1. Denison Mines Ltd. .... U
2. Rio Algom Ltd.
New Quirke Mine .... U
Panel Mine .... U
Stanleigh Mine .... U

* Exploration Activity, 1988 (keyed to Table)

TABLE 11.1. EXPLORATION ACTIVITY DURING THE YEAR.

NUMBER ON FIGURE 11.1	INDIVIDUAL OR COMPANY	ACTIVITY
1.	Aurora Gold Limited	Airborne and ground geophysical surveys, Plummer, Aberdeen Twps.
2.	Brink Mining & Res. Ltd.	Sampling, Aberdeen Twp.
3.	Dorchester Res. Inc.	Geological and sampling, Casson Twp.
4.	Dryden Resources Corp.	Diamond drilling, Runnalls Twp.
5.	Duration Mines Ltd.	Diamond drilling, ground geophysical surveys, stripping, sampling, Palmer, Olsen, Ryan, Nicolet Twps.
6.	Glen Auden Res. Ltd.	Diamond drilling, Neill Twp.
7.	Lacana Mining Corp.	Geological and ground geophysical surveys, sampling, Wishart Twp.
8.	Loydex Res. Inc.	Prospecting, stripping, sampling, Olsen Twp.
9.	Mori, R.	Geophysical survey, Galbraith Twp.
10.	Noranda Inc.	Ground geophysical and geochemical surveys, power stripping, Gapp Twp.
11.	Ontex Res. Ltd.	Ground geophysical, trenching, Olsen Twp.
12.	United Reef Petrol	Mag. survey, Albanel Twp.

Dryden Resources Corporation holds approximately 200 000 acres in Runnalls Township through an agreement with the Algoma Central Railway. During the summer of 1988, five holes totalling 1400 feet were drilled to test previously defined geophysical anomalies. The work was done by Massive Resources Ltd. (Massive Resources Staff, Massive Resources Ltd., personal communication, 1988).

Lacana Mining Corporation carried out a helicopter–borne magnetic and electromagnetic survey over part of 120 claims in Wishart Township in the Batchawana area in the summer of 1988. Geological mapping was carried out over 16 claims and self potential surveys were carried out over selected areas. Considerable stripping and sampling were done in the vicinity of gold occurrences discovered in 1987 by Y. Desjardins and D. Fleming of Sault Ste. Marie, and Loydex Resources Incorporated of Whitby, Ontario. Lacana Mining Corporation decided not to continue their option and the property reverted to Loydex Resources Incorporated (Lloyd Nelson, President, Loydex Resources Incorporated, personal communication, 1988).

Aurora Gold Limited of Calgary has 19 unsurveyed claims in Plummer and Aberdeen townships. The group includes the Rock Lake Mine, a past producer (copper) in Plummer Township. Airborne electromagnetic and magnetic surveys were carried out over the claim group in December 1987. Ground VLF, magnetic, and induced potential surveys were done over selected airborne anomalies in the winter of 1988 (Sault Ste. Marie Resident Geologist's files; G. Nolin, Vice President Explorations, Aurora Gold Limited, personal communication, 1988).

Richard Mori of Niagara–on–the–Lake holds 23 unsurveyed claims in the west–central part of Galbraith Township. An airborne magnetic and VLF–electromagnetic survey was carried out over the 23 claims in September 1988 (Assessment Files, Resident Geologist's Office, Sault Ste. Marie).

Glen Auden Resources Limited and WKAY Resources Inc. (Verse Lake Joint Venture) hold 133 contiguous unsurveyed claims in Neill Township at the east end of the Batchawana greenstone belt. WKAY Resources has an option to earn a 50 percent interest in the property through a C$200 000 expenditure. Five holes totalling 1760 feet (536 m) were drilled in August of 1988 to test anomalies found during an induced polarization survey carried out in December 1987. Hole VL88–3 intersected pyrite–bearing quartz–sericite schist which returned values of 140 220 and 560 ppb gold (Press release of Glen Auden Resources dated August 25, 1988; Glen Auden Resources Staff, Glen Auden Resources Limited, personal communication, November 1988).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The staff of the Sault Ste. Marie Resident Geologist's Office consists of Gerald Bennett, Resident Geologist; E. (Ted) Leahy, Staff Geologist; and Brenda Fremlin, Secretary.

Staff for the Sault Ste. Marie Drill Core Library for 1988 included Joe Melisek as Drill Core Library Geologist, replacing Jeff Donald who accepted a permanent position with the Information Technology Section of the Ministry of Northern Development and Mines. In July of 1988, Dale Messenger, Drill Core Library Assistant, accepted a six-month training assignment as acting Mining Claims Inspector. In a complimentary move, Paul Morra, Mining Claims Inspector, acted as Drill Core Library Assistant. Tami Pighin and Don Coletti were employed for the summer months under the Experience '88 program. John Nichols worked on a three-month co-op program affiliated with Alexander Henry High School.

A great deal of the Resident Geologist's time was divided between administrative matters and responding to ministry, industry, and public inquiries, which remained at a relatively high level in 1988. The Resident Geologist is a member of the Information Technology Subcommittee which deals with the planning and implementation of computer technology for the Mines and Minerals Division of the Ministry.

The Resident Geologist completed a compilation of the geology of the area of the Sault Ste. Marie–Elliot Lake sheet (Ontario Geological Survey, Geological Map 2419), for inclusion in the forthcoming Geological Map of Ontario.

Fourteen days were spent carrying out detailed geological mapping in the area of an unusual dolostone unit in Fenwick Township. About 15 days of laboratory work and report writing relating to this field work were also carried out. A summary of the results of this work is included in this report. The Resident Geologist gave an oral presentation and a poster display of the results of this work at the Ontario Mines and Minerals Symposium in December of 1988.

A poster display presenting the preliminary results of field work conducted in 1987 was presented at the Mines and Minerals Division "Open House" in Timmins during February 1988.

During 1988, the Resident Geologist made eight visits to active mines and four visits to mineral occurrences under current exploration.

The Staff Geologist's time, during 1988, was spent mostly on four concerns: mine hazard problems, revision to the Geological Data Inventory Folio (GDIF) system, educational matters, and office routine.

For mine hazards, most of the time was spent on the situation in the Municipality of Bruce Mines. Five sites were selected and a contract awarded to an engineering firm to carry out investigative work. Considerable rotary-percussion drilling, along with diamond drilling, was carried out. This resulted in clarification of the situation at some sites but indicated that more work was necessary at others. One street, Plummer Street, has been closed off until remedial work is done. Sand and fill under the road asphalt surface is being washed into an open stope located under the road. A safety net was designed and is in the process of being installed over this area as a temporary safety measure.

TABLE 11.2. GEOLOGICAL DATA INVENTORY FOLIOS (GDIFs) AVAILABLE FOR VIEWING AT THE SAULT STE. MARIE RESIDENT GEOLOGIST'S OFFICE (by township).

Published GDIFs

Township

Anderson
Aweres
Daumont
Gaudette
Gaudry
Hodgins
Hughes
Jarvis
Loach
Wlasy

Township

Norberg
Olsen
Raaflaub
Running
Shields
Tupper
Wishart
Vankoughnet

Unpublished GDIFs

Township

Deroche
Duncan
Fenwick
Gapp
Havilland
Jollineau
Ryan
Schembri
Way White

The Geological Data Inventory Folio's revision was necessitated by the reversion to 8 1/2 x 11 inch paper size, production costs, publication time, standardization, and updating. Industry acceptance of these GDIF publications has been very positive. A manual is being prepared by the Staff Geologist to be used by compilers of GDIFs across the Province. A meeting of GDIF compilers was held in December 1988 to standarize methodology.

Table 11.2 lists the GDIFs available for viewing.

Earth science education was promoted in a variety of ways in 1988. The Staff Geologist gave talks to four separate classes in the community of Echo Bay, and two in Sault Ste. Marie. A teaching field trip was laid out for the Central Algoma Secondary School, located in the town of Desbarats, and data and a display were prepared for a visiting high school group from London, Ontario. Two daycare centres in Sault Ste. Marie requested, and were supplied with, very basic sets of rocks and minerals, mostly with the idea of showing children of this age that there are differences in color, appearance, and texture in rocks and minerals.

A demonstration of Ontario rocks and minerals, along with various maps and reports, was set up and manned for one day at Brimley, Michigan, at the request of the Michigan Department of Natural Resources.

Assistance was provided to the Sault Ste. Marie Museum for their display about the Industrial Empire of Francis Clergue, the beginnings of iron ore mining at Wawa, and the manufacture of steel at Sault Ste. Marie. Contacts are presently being maintained with the museum staff in regards to mining–related exhibits planned for the Skylight Gallery and the "hands–on" Discovery Gallery.

Most of the Staff Geologist's time was spent on routine office matters. This included discussions with prospectors, company geologists, consulting geologists, rock hounds, teachers, the general public, and other government personnel. Advice was given on rock and mineral identification, assays, exploration, maps and reports, assessment files, etc. Material in the form of journal articles, newspaper articles, and theses was added to the office collections.

The Staff Geologist attended meetings, both in and out of Sault Ste. Marie, pertaining to the Geological Data Inventory Folios and to mine hazards. Mine hazard meetings at Bruce Mines usually included town officials and representation, at various times, from Ministry of Labour, Ministry of Natural Resources, Ministry of the Environment, and Ministry of Transportation.

A REPORT ON A RECENTLY IDENTIFIED DOLOSTONE UNIT IN FENWICK TOWNSHIP, GOULAIS BAY AREA, DISTRICT OF ALGOMA

by G. Bennett, P. Born, and K. Hatfield.

INTRODUCTION

Born *et al.* (1986) and Born (1987) noted and briefly described a previously unrecognized occurrence of dolostone and associated clastic rocks in Fenwick Township, approximately 17 miles (27 km) northwest of Sault Ste. Marie. Subsequent field examinations by the authors, in the fall of 1987, indicated that these dolomitic rocks may be unique amongst the known Proterozoic rocks of Ontario and deserve further study to provide an acceptable stratigraphic correlation.

In the spring and fall of 1988, the known extent of the dolostone, and some of the surrounding rocks, was mapped by pace and compass methods at a scale of 1:8000. Supplementary aerial photographs supplied by the Sault Ste. Marie District Office of the Ministry of Natural Resources were used as additional control. The mapping was done while the leaves were off the trees. It is believed that most rock exposures of any significant size were located and examined during the mapping.

A small knob, about 100 m across and 10 m high, is located about 100 m southwest of a gravel pit (Figure 11.2). This area was mapped at a scale of 1:600 using control pickets accurately located by a closed transit survey (Figure 11.3). The knob, which contains the largest exposures of the dolostone unit in the area, is located at 84°27'30"W and 46°45'51"N.

ARCHEAN ROCKS

A few outcrops of Archean metavolcanic rocks are located in the northern part of the area of Figure 11.2. These rocks form part of an Early Precambrian, east–trending metavolanic sequence which extends northward to Havilland Bay (Born *et al.* 1986; Born 1987). The contact between the Archean and the Huronian rocks is inferred to be a fault.

GOWGANDA AND LORRAIN FORMATIONS

A few outcrops of siltstone, wacke, and argillite of the Gowganda Formation occur on the south face of a hill on the north side of Highway 552 (Born 1987).

Within the area of Figure 11.2, the Lorrain Formation is comprised mainly of pale grey to white quartz arenite which is commonly sheared and brecciated. In some of the sheared areas, the quartz arenite is altered, giving a pale to pronounced pink coloration. Fractures are commonly coated with red hematite. The quartz arenite is locally cut by irregular quartz veins, many of which have also been subjected to brecciation and alteration. A thin bed of quartz pebble conglomerate containing some pale jasper pebbles was noted in the Lorrain Formation near the eastern part of the area mapped.

GORDON LAKE FORMATION

A group of lithologies which include red siltstone and arenite, purple and green siltstones, chert and dolostone are assigned to the Gordon Lake Formation of the Huronian Supergroup.

DOLOSTONE AND CHERT

There are two main outcrop areas of dolostone within the map area. One outcrop area occurs along the north side of the east–west ridge of the Lorrain Formation in the western part of the area (*see* Figure 11.2). The second area of dolostone exposures occur on the small knob referred to previously (*see* Figure 11.3).

Mapping of the dolostone and associated rocks, in the area of the knob, suggests that the rocks at that location form an open synform plunging 50° to 70° to the west (*see* Figure 11.3). A northeast–trending fault crosses the dolostone and associated clastic rocks. The overall thickness of the dolostone unit is about 25 m south of the fault, but may be much thicker north of the fault. No facing directions were found, but it is assumed that the rocks are not overturned (*see* Figure 11.3).

In the area of the dolostone knob, the lowermost third of the dolostone sequence consists mainly of very fine grained, pale pink to reddish pink dolostone, and intercalated grey to pink metachert. Indi-

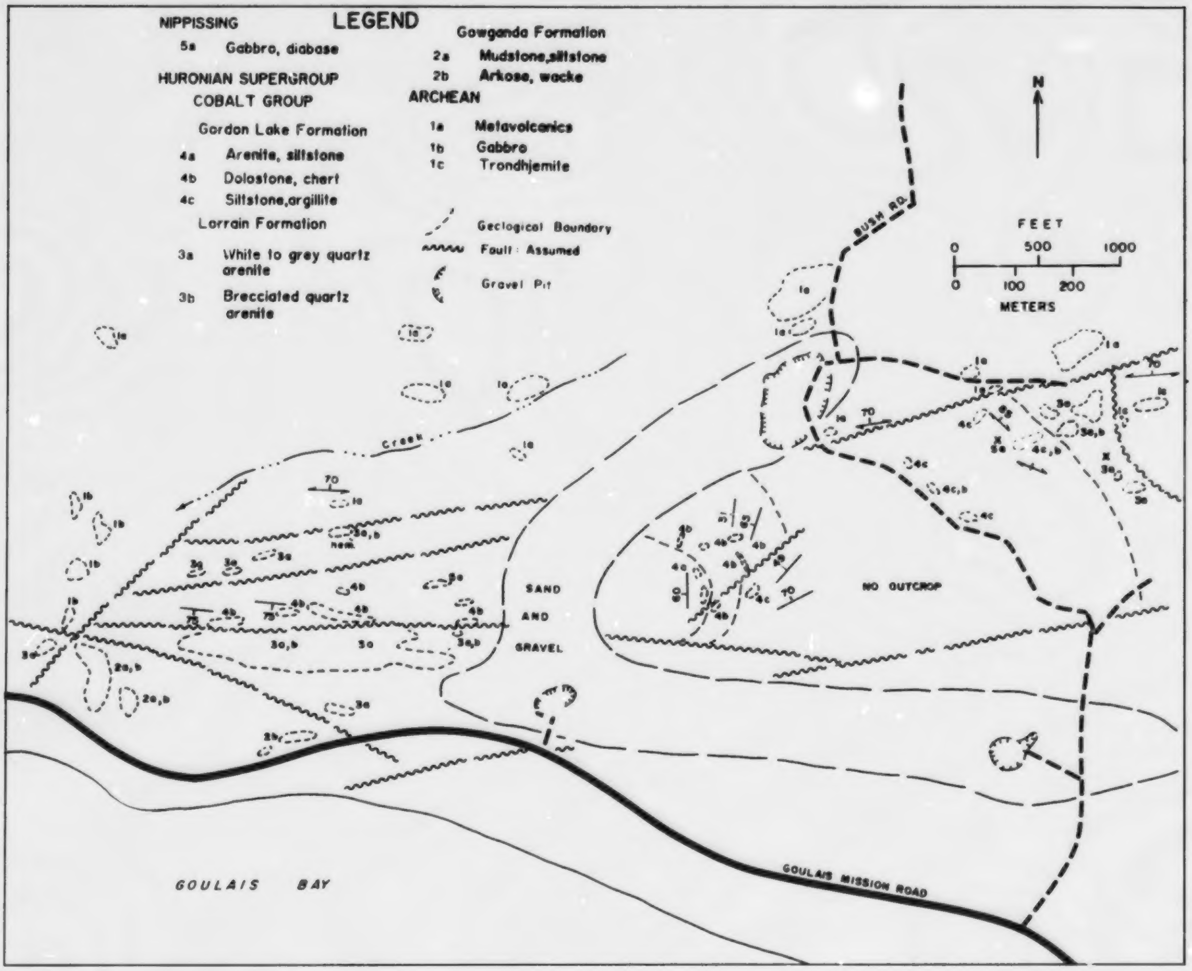
LEGEND
NIPPISSING
5a Gabbro, diabase
HURONIAN SUPERGROUP
COBALT GROUP
Gordon Lake Formation
4a Arenite, siltstone
4b Dolostone, chert
4c Siltstone, argillite
Lorrain Formation
3a White to grey quartz arenite
3b Brecciated quartz arenite
Gowganda Formation
2a Mudstone, siltstone
2b Arkose, wacke
ARCHEAN
1a Metavolcanics
1b Gabbro
1c Trondhjemite
Geological Boundary
Fault: Assumed
Gravel Pit
N
FEET
0 500 1000
0 100 200
METERS
BUSH RD.
creek
SAND AND GRAVEL
NO OUTCROP
GOULAIS BAY
GOULAIS MISSION ROAD

Figure 11.2. *Geology of part of Fenwick Township.*

vidual dolostone beds are from a few millimetres to at least 1 m thick. The metachert beds have a similar thickness range but form less than 25 percent of the visible section. The chert beds are generally fractured and disrupted within the less competent carbonate rock.

Thin seams of red hematite and veinlets of recrystallized euhedral dolomite are common. A bed of grey, medium–grained, calcareous, quartz arenite, at least 1 m thick, was found near the base of the dolostone.

No clearly identifiable stromatolites were observed in the dolostone of Fenwick Township but irregular and wavy, closely spaced laminae of brownish chert, suggestive of algal mats, were observed in the northeastern part of the knob.

Examination of nine thin sections shows that the pink dolomite is mainly very fine grained (0.01 to 0.02 mm), anhedral dolomite grains. Locally, there are a few clear, apparently clastic, quartz grains. Pyrite is a common accessory mineral.

Pale grey, clastic dolostone is common on the dolostone knob and is the most abundant rock type in the upper part of the carbonate unit. The weathered surface is generally pale grey in colour and has a sandpaper–like feel due to the presence of the resistant quartz grains. This rock is a calcarenite consisting of variable proportions of angular to subrounded sand–sized clasts of fine–grained dolostone, and subrounded to well–rounded quartz grains. Some of the dolostone clasts are irregular in shape and many have overgrowths of dolomite. Well–developed ooliths were observed in one thin section of clastic dolostone. The clastic dolostone generally forms thick beds separated by thin beds of fine–grained dolostone or chert.

Coarse, pink coloured barite occurs as a few lensoid masses, up to 50 cm across, within the clastic dolostone on the south side of the knob. The barite

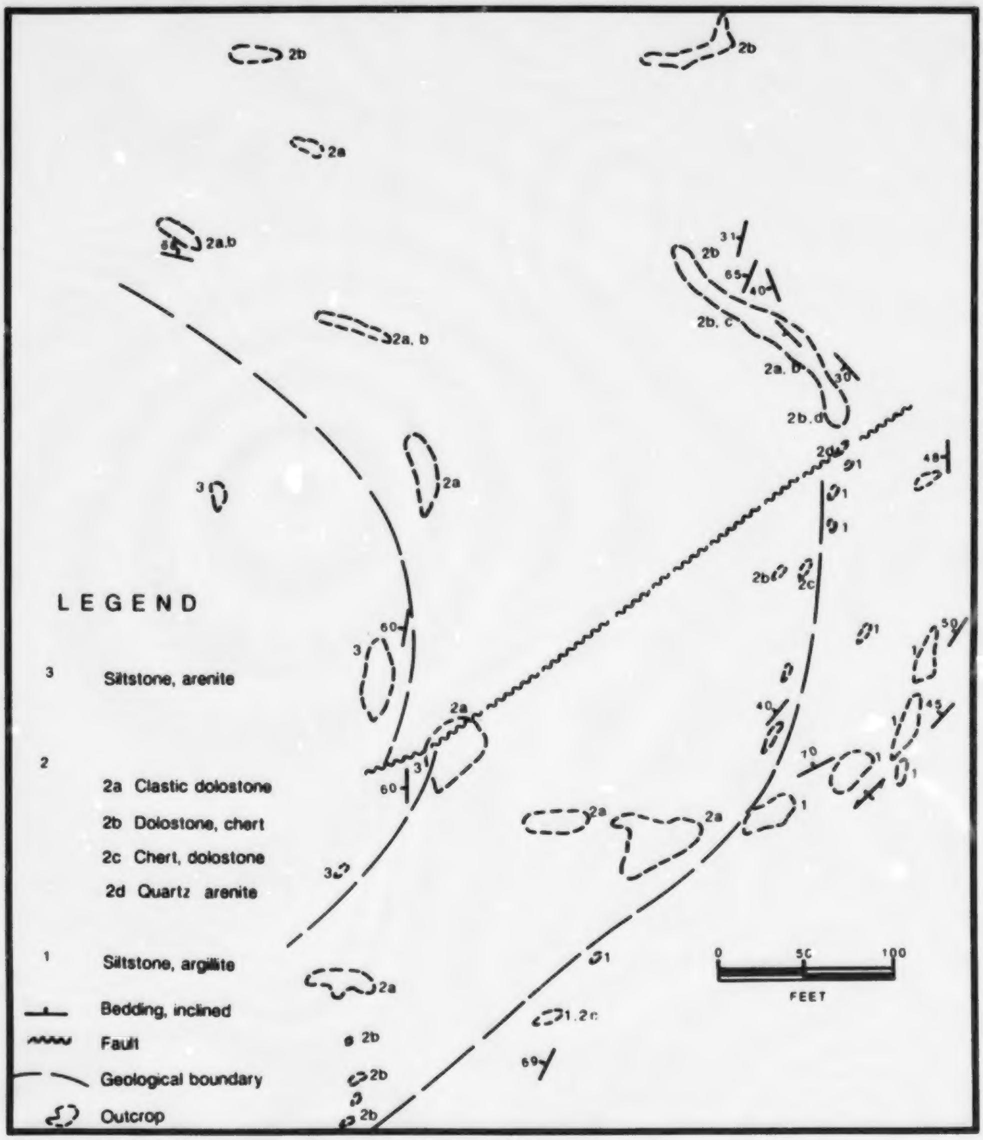
LEGEND
3 Siltstone, arenite
2
2a Clastic dolostone
2b Dolostone, chert
2c Chert, dolostone
2d Quartz arenite
1 Siltstone, argillite
Bedding, inclined
Fault
Geological boundary
Outcrop
0
50
100
FEET
2a
2b
2a, b
2b, c
2b, d
2c
3
1
1, 2c
31
65
40
30
48
60
59
45
70
69

Figure 11.3. *Geology of the Dolostone Knob, Fenwick Township.*

may represent nodules formed soon after the deposition of the carbonate.

Grey, buff, and brown weathering dolostone–chert is exposed immediately north of the large outcrops of the Lorrain Formation in the western part of the map area (*see* Figure 11.2). The southern contact between the Lorrain quartz arenites and the dolostone is not exposed but lies within an east–trending, narrow, linear, recessive zone about 10 m wide, and is inferred to be a fault. Outcrops of sheared quartz arenite with much red and specular hematite also occur north of the dolostone exposures, suggesting that in the western part of the map area the dolostone unit is an east–trending, elongated, fault block within the Lorrain Formation.

The dolostone in the western part of the area is mainly buff to pink, very fine grained, with brownish cherty laminations. Some massive, brown weathering, grey, clastic dolostone is also present. Much of the exposure of dolostone in the western part of the area shown in Figure 11.2, is on steep rock faces and large blocks which are rotated by frost action. A few determinations of attitude indicate that the bedding dips steeply. The strike of the bedding approximately follows the strike of the Lorrain Formation contact. It is hazardous to estimate the thickness of dolostone in this area, but 30 m seems a reasonable minimum.

ROCKS OVERLYING THE DOLOSTONE

At the western side of the knob (*see* Figure 11.3), the clastic dolostone is seen to be directly overlain by deep red sandstone, and red to pink laminated siltstone. The contact between the red beds and the dolostone is abrupt and concordant. Only a few exposures of this overlying unit were found, but loose blocks are common along the western flank of the knob.

ROCKS UNDERLYING THE DOLOSTONE

In the area of the knob (*see* Figure 11.3), the dolostone unit directly overlies (assuming no overturning) highly fractured and sheared, green and maroon siltstone and argillite. Less sheared areas of the siltstone display laminations of pale green siltstone, argillite, and grey to pinkish chert. A few beds of recrystallized chert at least 20 cm thick, and one dolostone bed of similar thickness, were observed within the siltstone.

On the east side of the bush road (*see* Figure 11.2) are outcrops of grey to reddish grey weathering siltstone displaying a chocolate brown to purplish colour on fresh surfaces. There is little evidence of bedding in this unit. Angular quartz fragments, 1 cm or so across, distributed throughout some outcrops of purple siltstone, are interpreted as broken and displaced quartz veins. Four thin sections show that the purple siltstone consists of subrounded to angular quartz and feldspar (about 0.02 mm) with minor hematite, carbonate, and white mica. Euhedral grains of magnetite were identified in one thin section. The mineral assemblage of the siltstones is indicative of greenschist facies metamorphism.

A narrow, disrupted bed of dolostone, similar in appearance to the fine-grained dolostone on the knob, was observed in this purple siltstone on the east side of the bush road (*see* Figure 11.2). Outcrops of purple siltstone, some chert, and dolostone, were found between the road and the creek near the eastern end of the map area (*see* Figure 11.2). Bedding-cleavage relationships seen in a few rotated blocks suggest that the area has been folded.

CORRELATION OF THE DOLOSTONE AND ASSOCIATED ROCKS

Born *et al.* (1986) and Born (1987) provisionally correlated dolostone in the northwest quarter of Fenwick Township with the Espanola Formation of the Huronian Supergroup. However, in the fall of 1987, the authors carried out additional investigations of the dolostone and associated rocks and concluded that the original provisional correlation was unlikely. Field investigations suggest that the dolostone and associated clastic rocks are most likely equivalent to the Gordon Lake Formation of the upper Huronian for the following reasons:

1. The presence of red beds above and below the dolostone unit rules out a correlation with pre–Cobalt Group rocks, since it is well established that red, pink, and brown rocks are not found in rocks older than the Gowganda Formation (Roscoe 1969, p.80.)
2. The metamorphic grade of the dolostone assemblage in Fenwick Township precludes deposition after the Penokean orogenic event of about 1800 Ga (Van Schmus 1965).
3. A variety of sedimentary features indicate that the Gordon Lake Formation was deposited in a shallow, active, aqueous environment such as a tidal flat (Frarey 1977, p.57; Robertson 1973, p.181; Wood 1973, p.91). The recognition of nodules of gypsum and anhydrite in the Gordon Lake Formation indicates local evaporitic conditions (Wood 1973, p.85). The presence of ooliths and sulphate (barite) in the dolostone of Fenwick Township indicates a similar depositional environment to that proposed for the Gordon Lake Formation. The close association of some dolostones with evaporitic deposits is noted by Pettijohn (1975, p.365).
4. Thin beds of dolomite have been reported from the Gordon Lake Formation, near the Thessalon River east of Sault Ste. Marie (Hofmann *et al.* 1980). To the authors' knowledge, this is the only previously reported occurrence of dolostone in the upper Huronian. In addition, the authors have observed several occurrences of intraformational conglomerates containing dolostone clasts in the Gordon Lake Formation in the Gordon Lake area, north of Bruce Mines. The lack of references to dolostone east of the Gordon Lake area suggests that the Gordon Lake area was near the (present) eastern limit of the basin of dolostone deposition.
5. The red laminated siltstones and green siltstone and chert associated with the Fenwick Township dolostone are common lithologies of the Gordon Lake Formation. In fact, the mineral assemblages of the purple siltstones of Fenwick Township are identical to siltstones in the Gordon Lake Formation.

CORRELATION WITH THE CHOCOLAY GROUP OF MICHIGAN

There has been a long standing debate as to stratigraphic equivalence of the Huronian rocks of Ontario and the Middle Precambrian rocks of the Lake Superior region of Michigan. The lithological and stratigraphic similarities of the Chocolay Group (and equivalent groups further west) and the Cobalt Group have been pointed out by Young (1966) and Church and Young (1970). More recently, Young (1983) and Cannon (1975) discuss this proposed correlation. However, this time–stratigraphic correlation has not been widely accepted (e.g., Morey 1973, p.242–244; Card 1978, p.24), since radiometric dating of rocks considered to underlie the Chocolay Group provide evidence that the Chocolay Group is younger than the Huronian Supergroup of Ontario (Van Schmus 1976).

In spite of the apparent age differences, the similarity of the sequences is striking. Both the Chocolay Group and the Cobalt Group begin, at least in part, with matrix–supported conglomerates (Enchantment Lake and Gowganda Formations, respectively) overlain by quartz arenites (Mesnard and Lorrain Formations, respectively). The thick dolostone of the Kona Dolomite which overlies the Mesnard Quartzite of the Chocolay Group (Gair and Thaden 1968; Young 1983) shares many of the features of the dolostone unit of Fenwick Township.

ECONOMIC GEOLOGY AND SUGGESTIONS TO PROSPECTORS

The barite occurrence on the south side of the knob seems to occur as discontinuous lenses, thereby making the possibility of a large occurrence of a high–grade deposit unlikely. Nevertheless, more detailed examination of the barite occurrence is warranted.

The Kona Dolomite of Michigan is known to contain subeconomic stratabound copper deposits. The only copper mineralization noted in the Fenwick Township dolostone was minor chalcopyrite and pyrite in a dolostone bed within siltstone about 200 m east of the bush road (*see* Figure 11.2).

SAULT STE. MARIE DRILL CORE LIBRARY

The Sault Ste. Marie Drill Core Library serves the mining public in both the Wawa and Sault Ste. Marie Resident Geologists' districts. It provides an inventory of diamond drilling and field samples from various properties and townships in the Sault Ste. Marie Mining Division. Furthermore, facilities are available for logging, sampling, assaying, and microscopic work.

Activities for 1988 included the addition of 85 holes from 13 townships in the Sault Ste. Marie Mining Division. These new donations provided the library with an additional 9000 m of core, bringing the total stored in the facility to 79 000 m. The Sault Ste. Marie Resident Geologist's District collected 2000 m of core and 7000 m were collected from the Wawa Resident Geologist's District.

The facility saw increased use, with the majority of clients examining and sampling core from the Batchawana belt. Duration Mines Limited conducted an extensive program of relogging and resampling of core from the Jogran–Phelps Dodge Property in Ryan Township. Duration's goal is to investigate the gold values which accompany the copper–molybdenum mineralization on their property in Palmer and Ryan townships.

The Drill Core Library staff gave oral presentations and geological field tours to Ministry of Natural Resources Junior Ranger camps at Ranger Lake and Mississaga Provincial Park. The Drill Core Library Geologist gave an oral presentation on the general geology and mineral occurrences in the Sault Ste. Marie area as a guest speaker at a local service club luncheon.

Tours of the Drill Core Library facility were provided for groups of students from a local public school and a high school from London, Ontario. During a convention of the International Bush Pilots Association, held in Sault Ste. Marie in August 1988, P. Morra and J. Melisek gave short talks on the geology and history of the Sault–Agawa Canyon corridor to the pilots during an excursion aboard the Algoma Central Railway tour train.

In 1988, we witnessed the Drill Core Library play a more important role in exploration, with increased use of the facility, and its inventory, by government and industry personnel. Persons or companies wishing to donate core or receive an inventory catalogue, should contact the Sault Ste. Marie Resident Geologist's Office.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

John A.C. Fortescue, of the Geophysics/Geochemistry Section, completed the second part of a three–year regional geochemical survey of the Batchawana greenstone belt. In 1988, a total of 947 lake sediment and water cores were collected. Part of the metavolcanic–metasedimentary belt and some of the surrounding granitic and Keewenawan rocks west of 84°W were covered by the survey (Fortescue 1988).

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12. Timmins Resident Geologist's District—1988

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INTRODUCTION

The level of exploration and development activity was high in the early part of 1988; a carry–over from 1987. However, the October 1987 stock market "crash" resulted in the stock prices of junior mining issues falling dramatically. Even with the flow through tax incentives being in place until the end of 1988, there was a decrease in the amount of money raised by this method. This resulted in a decline in exploration and development activity in late 1988. Fortunately, base–metal prices rose in 1988 and the gold price was still quite high. Base–metal exploration should increase in 1989 and gold should continue to be a sought after commodity. Since major mining companies have been making record profits, an increase in exploration expenditures is anticipated. This will somewhat alleviate the shortfall in exploration capital formerly supplied by the junior resource sector.

CLAIM STAKING ACTIVITY

There were 5867 claims recorded in the Porcupine Mining Division from January to the end of November 1988. There are presently in excess of 34 500 active claims in the mining division representing 1 380 000 acres of ground being explored. This figure does not include additional exploration programs on patented ground.

Intensive staking was concentrated on the 64–township area surrounding Timmins and covered by the Ontario Geological Survey 1988 Input Survey Release. Additional areas of intensive staking were the Swayze greenstone belt and the English, Semple, and Zavitz townships area. Although large numbers of claims were not involved, staking activity also occurred in several numbered areas in the vicinity of the Attawapiskat River. This staking is the first record of interest in the particular areas involved.

ONTARIO MINERAL EXPLORATION PROGRAM

From December 1987 through November 1988, 36 programs in the Porcupine Mining Division were designated to receive assistance under the Ontario Minerals Exploration Program (OMEP). Expenditures totaled $9 252 395 in 1988. From this total, $8 309 420 were eligible for OMEP assistance.

MINING ACTIVITY

OPERATING MINES

BASE METALS

Falconbridge Limited, Kidd Creek Mine

Although complete figures were unavailable at the time of writing, projected production to the end of 1988 was expected to be 3 229 000 t from the No. 1 Mine and 1 012 000 t from the No. 2 Mine. The total ore mined to the end of 1988 was estimated to be 4 241 000 t with 4 300 000 t being milled. The larger figure for ore milled included ore from previously mined surface stockpiles. Grades for 1988 production were: 71 g/t silver, 2.99 percent copper, 5.89 percent zinc, and 0.16 percent lead. Projected lateral development to the end of 1988 at the No. 1 Mine and No. 2 Mine totalled 4710 m and 4181 m, respectively.

Vertical development at the No. 1 Mine and No. 2 Mine totalled 3380 m and 1908 m, respectively.

Diamond drilling at the Kidd Creek Mine amounted to 30 500 m. Of that total, 10 000 m were drilled in an underground program, mainly from the 4600–foot level, exploring for satellite orebodies in areas of favourable geology. The balance of the drilling was to delineate and define the ore by drilling off the deposit at depth below 4600 feet to 7000 feet. Reserves for the deposit are currently being re–calculated to include the results from drilling below the 4600–foot level and will be re-

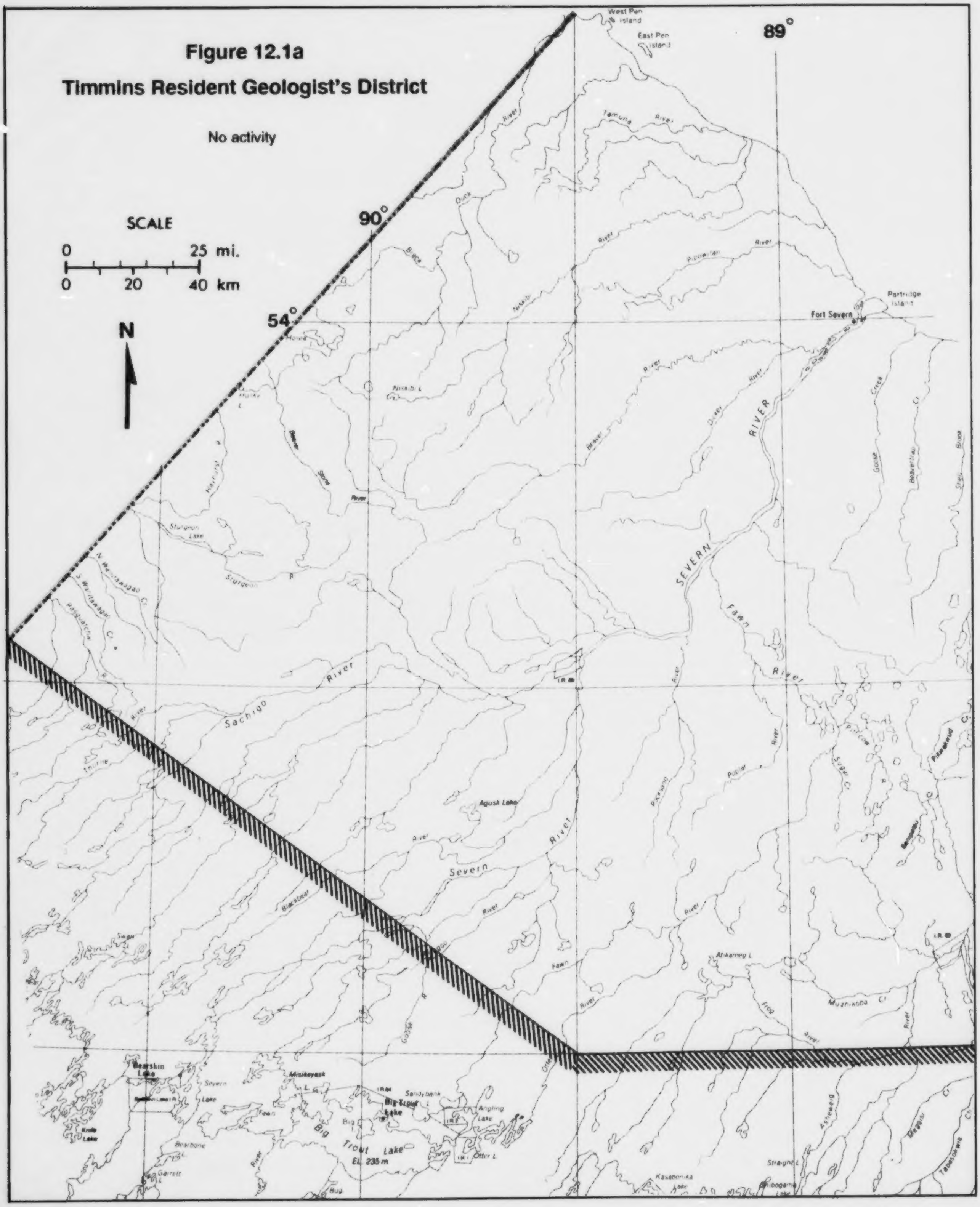

Figure 12.1a

Timmins Resident Geologist's District

No activity

SCALE
0
25 mi.
0
20
40 km
N
90°
89°
54°
West Pen Island
East Pen Island
Tamuna River
Duck River
Black River
Pipowitan River
Partridge Island
Fort Severn
Beaver River
Owl River
Goose Creek
Beaverhouse Cr.
Niskibi L.
Beaver Stone River
Sturgeon Lake
Sturgeon R.
SEVERN RIVER
Fawn River
Sachigo River
Agusk Lake
Severn River
Blackbear River
Fawn River
Atikameg L.
Frog River
Muzhikaba Cr.
Bearskin Lake
Severn Lake
Miniskoyask L.
Sandybank L.
Big Trout Lake
Angling Lake
Big Trout Lake
EL 235 m
Otter L.
Bearbone L.
Garrett L.
Knife Lake
Kasabonika Lake
Straight L.
Shibogama Lake
Asheweig
Tabaccoweis Cr.

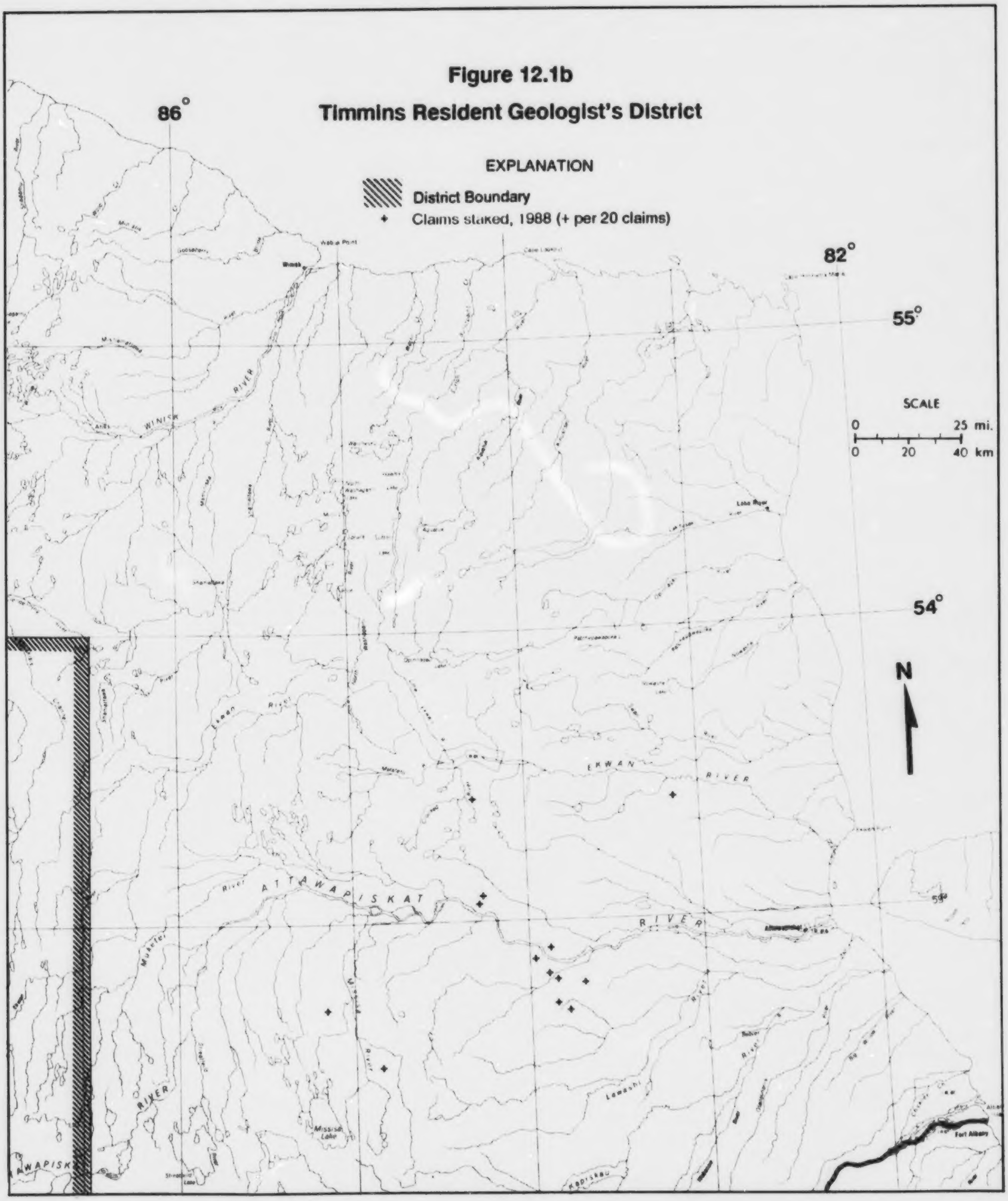

Figure 12.1b
Timmins Resident Geologist's District

EXPLANATION
▨ District Boundary
+ Claims staked, 1988 (+ per 20 claims)
86°
82°
55°
54°
SCALE
0
25 mi.
0
20
40 km
N
WINISK RIVER
EKWAN RIVER
ATTAWAPISKAT RIVER
Missisa Lake
Fort Albany

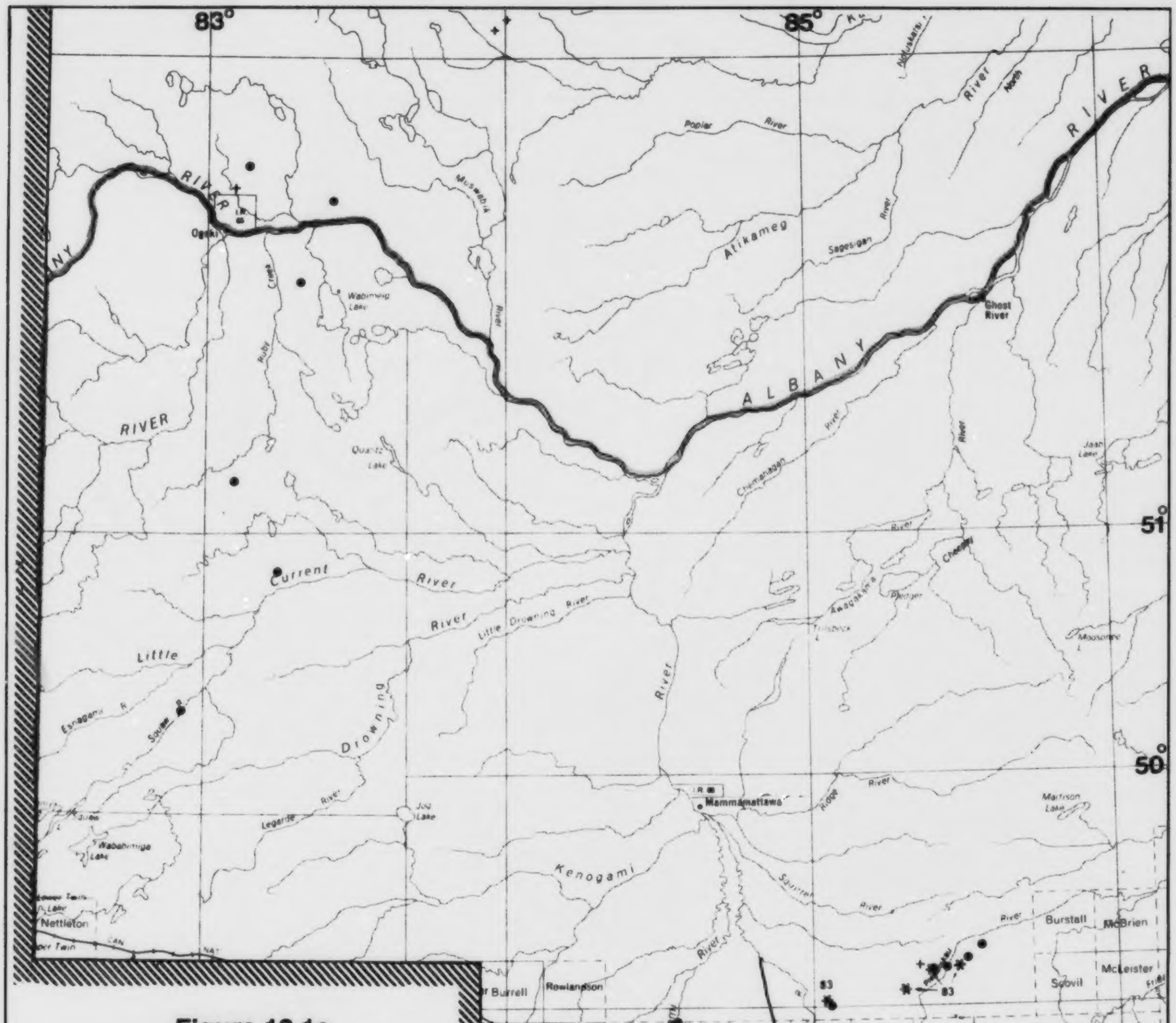

Figure 12.1c
Timmins Resident
Geologist's District

EXPLANATION
▨ District Boundary
+ Claims Staked, 1988 (+ per 20 claims)
● Assessment Work Submitted, 1988
* Exploration Activity, 1988 (keyed to Table 12.1)
N
SCALE
0 25 mi.
0 20 40 km
83°
85°
51°
50°
ALBANY RIVER
RIVER
Ogoki
Poplar River
Atikameg
Sagesigan River
Ghost River
Chemahagan River
Current River
Little Drowning River
Little
Drowning
River
Kenogami
Mammamattawa
Squirrel River
Nettleton
Burrell
Rowlandson
Burstall
McBrien
Scovil
McLeister
Shuel
Mulloy
Fintry
Auden
Rogers
Fushimi
Bannerman
Ritchie
Mulvey
Goldwin
Sweet
Kohler
McCoig
Palmquist
McMillan
Gill
Calstock
Stoddart
Hanlan
Casgrain
Shannon
Sankey
Fleck
Hearst
Devitt
Eilber
Mattice
McCowan
Mercer
Cross
Arnott
Storey
Nassau
Irish
Way
Kendall
Hiawatha
Frost
McEwing
Langemarck
Verdun
Landry
Coppell
Lowther
Shetland
Staunton
Barker
McCrea
Nagagami
Elgie
Newlands
Dowsley
McFarlan
Templeton
Ebbs
Orkney
Magladery
Shearer
Pannell
77
Foch
Lessard
Wickstead
Haig
Farquhar
Alderson
Talbot
Scholfield
Caithness
Rykert
Fergus
Ecclestone
Hornepayne
Drew
Choquette
Chelsea
Larkin
Lascelles
Woolrich
Fraser
Roche
Pelletier
50
Doherty
Abbott
Oba
Walls
Minnipuka
Byng
Cromlech
Radisson
Marjorie
Legge
Puskuta
Erickson
Missinaibi
Fire River
Hook
Hayward
Champlain
Mons
83
104

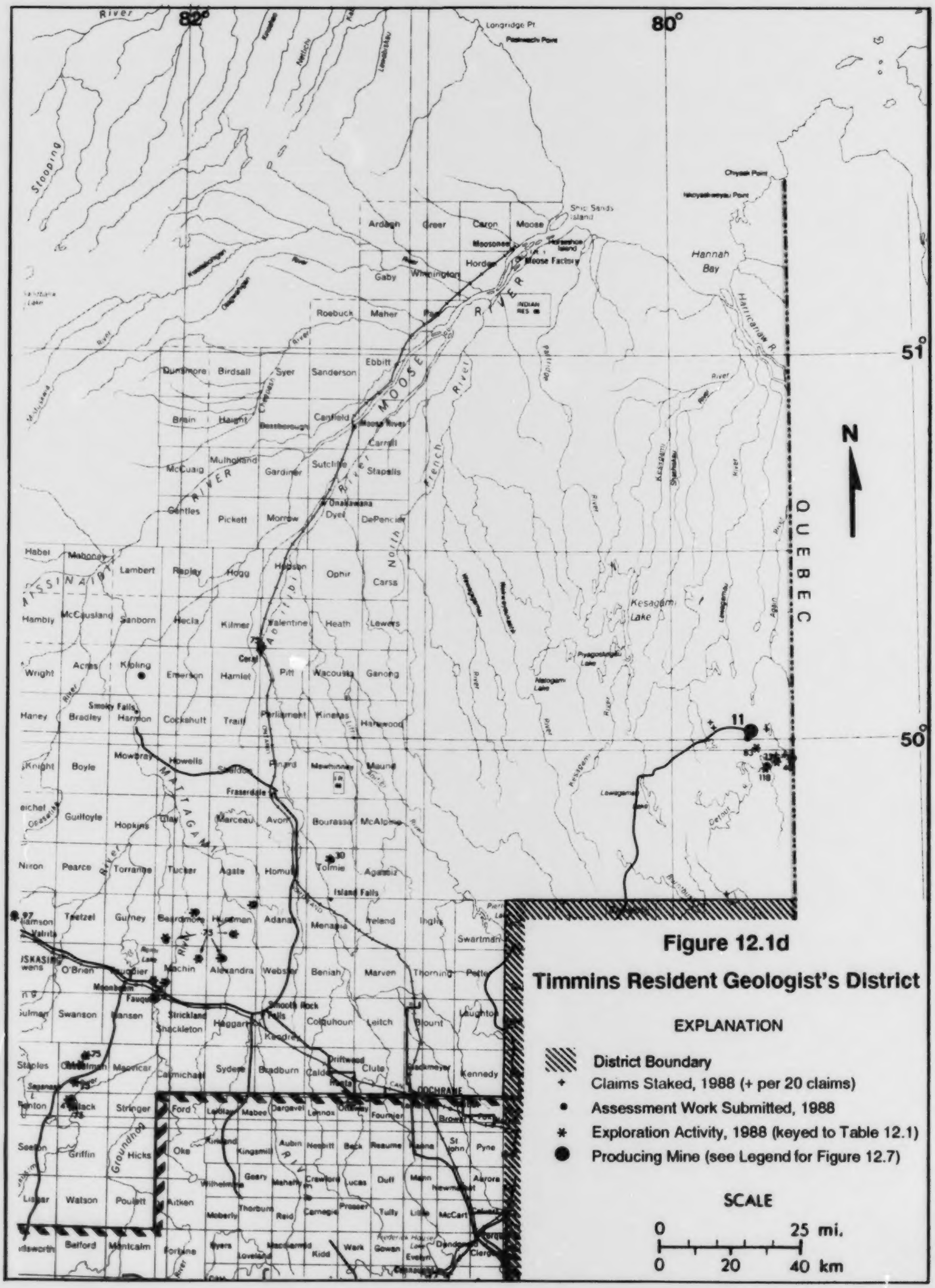
82°
80°
51°
50°
N
QUEBEC
Longridge Pt
Ship Sands Island
Hannah Bay
Moosonee
Moose Factory
Horseshoe Island
INDIAN RES.
MOOSE RIVER
Stooping River
North French River
Harricanaw R.
Kesagami Lake
Kesagami River
Lawagamau Lake
Detour L.
ABITIBI River
MATTAGAMI River
MISSINAIBI
Groundhog River
Ardagh
Greer
Caron
Moose
Gaby
Horden
Roebuck
Maher
Ebbitt
Dunsmore
Birdsall
Syer
Sanderson
Brain
Haight
Canfield
Moose River
Carroll
McCuaig
Mulholland
Gardiner
Sutcliffe
Stapells
Gentles
Pickett
Morrow
Onakawana
Dyer
DePencier
Habel
Mahoney
Lambert
Rapley
Hogg
Hepson
Ophir
Carss
Hambly
McCausland
Sanborn
Hecla
Kilmer
Valentine
Heath
Lewers
Wright
Acres
Kipling
Emerson
Hamlet
Pitt
Wacousta
Ganong
Coral
Haney
Bradley
Smoky Falls
Harmon
Cockshutt
Traill
Parliament
Kineras
Harewood
Knight
Boyle
Mowbray
Howells
Sheldon
Pinard
Mewhinney
Maund
Fraserdale
Guilfoyle
Hopkins
Marceau
Avon
Bourassa
McAlpine
Nixon
Pearce
Torrance
Tucker
Agate
Homuth
Tolmie
Agassiz
Island Falls
Teetzel
Gurney
Beardmore
Huntsman
Adanac
Menapia
Ireland
Inglis
Swartman
Valrita
Kapuskasing
O'Brien
Fauquier
Machin
Alexandra
Webster
Beniah
Marven
Thorning
Moonbeam
Gulman
Swanson
Hansen
Strickland
Shackleton
Haggart
Smooth Rock Falls
Kendrey
Colquhoun
Leitch
Blount
Staples
Casgrain
Macvicar
Carmichael
Sydere
Bradburn
Calder
Clute
Driftwood
Glackmeyer
Kennedy
Stringer
Ford
Leblanc
Mabee
Dargavel
Lennox
Ottaway
Fournier
Cochrane
Hunta
Brower
Pyne
Seaton
Griffin
Hicks
Oke
Kingsmill
Aubin
Nesbitt
Beck
Reaume
Mann
St John
Aurora
Lisgar
Watson
Poulett
Aitken
Wilhelmina
Geary
Mahaffy
Crawford
Lucas
Duff
Newmarket
Moberly
Thorburn
Reid
Carnegie
Prosser
Tully
Little
McCart
Ellsworth
Belford
Montcalm
Fortune
Byers
Loveland
Macdiarmid
Kidd
Wark
Gowan
Frederick House Lake
Evelyn
Dundonald
Clergue
11
30
73
97
175
118
83

Figure 12.1d
Timmins Resident Geologist's District

EXPLANATION
▨ District Boundary
+ Claims Staked, 1988 (+ per 20 claims)
• Assessment Work Submitted, 1988
* Exploration Activity, 1988 (keyed to Table 12.1)
● Producing Mine (see Legend for Figure 12.7)
SCALE
0 25 mi.
0 20 40 km

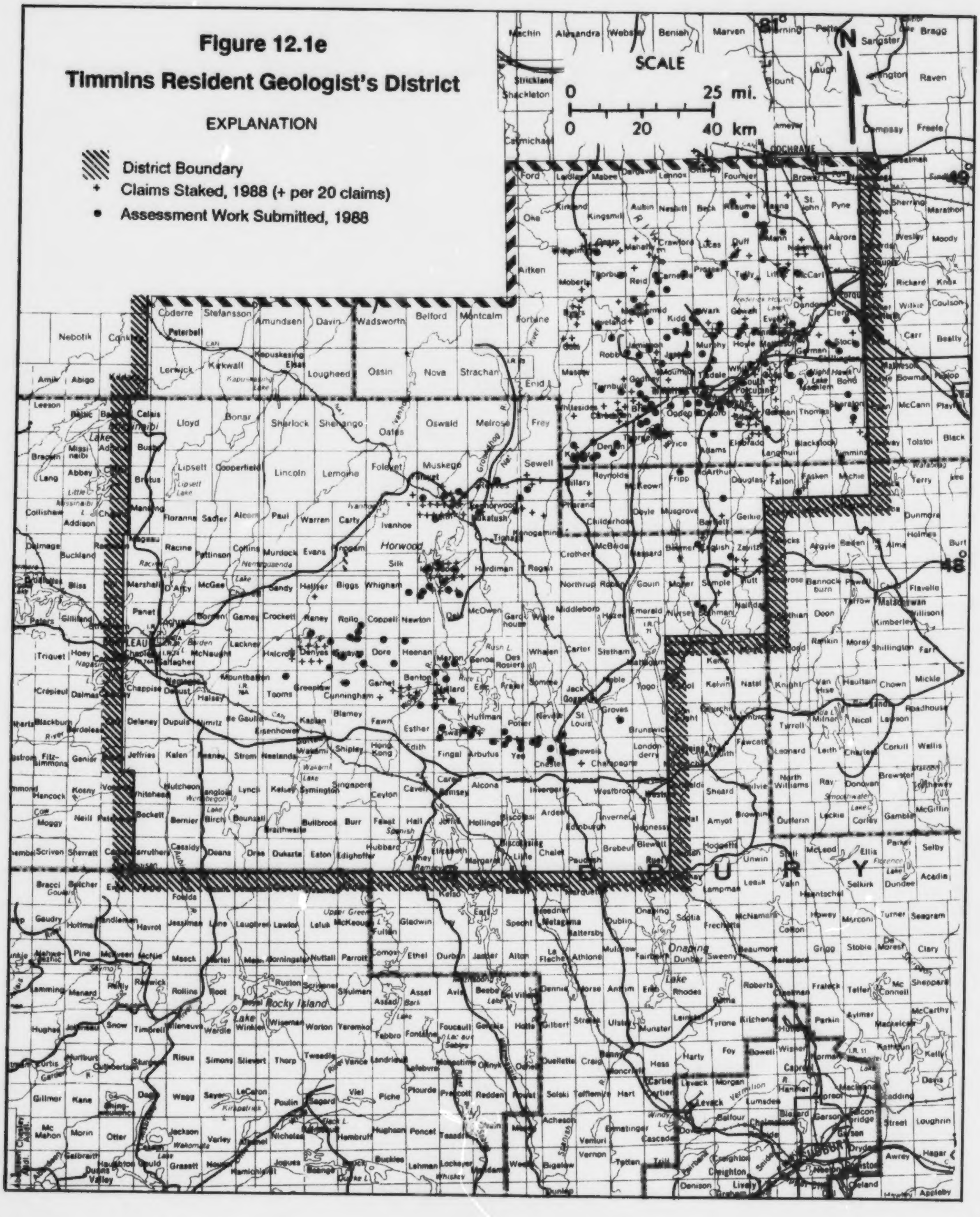

Figure 12.1e

Timmins Resident Geologist's District

EXPLANATION
▨ District Boundary
+ Claims Staked, 1988 (+ per 20 claims)
● Assessment Work Submitted, 1988
SCALE
0
25 mi.
0
20
40 km
N
81°
49°
48°
COCHRANE
SUDBURY

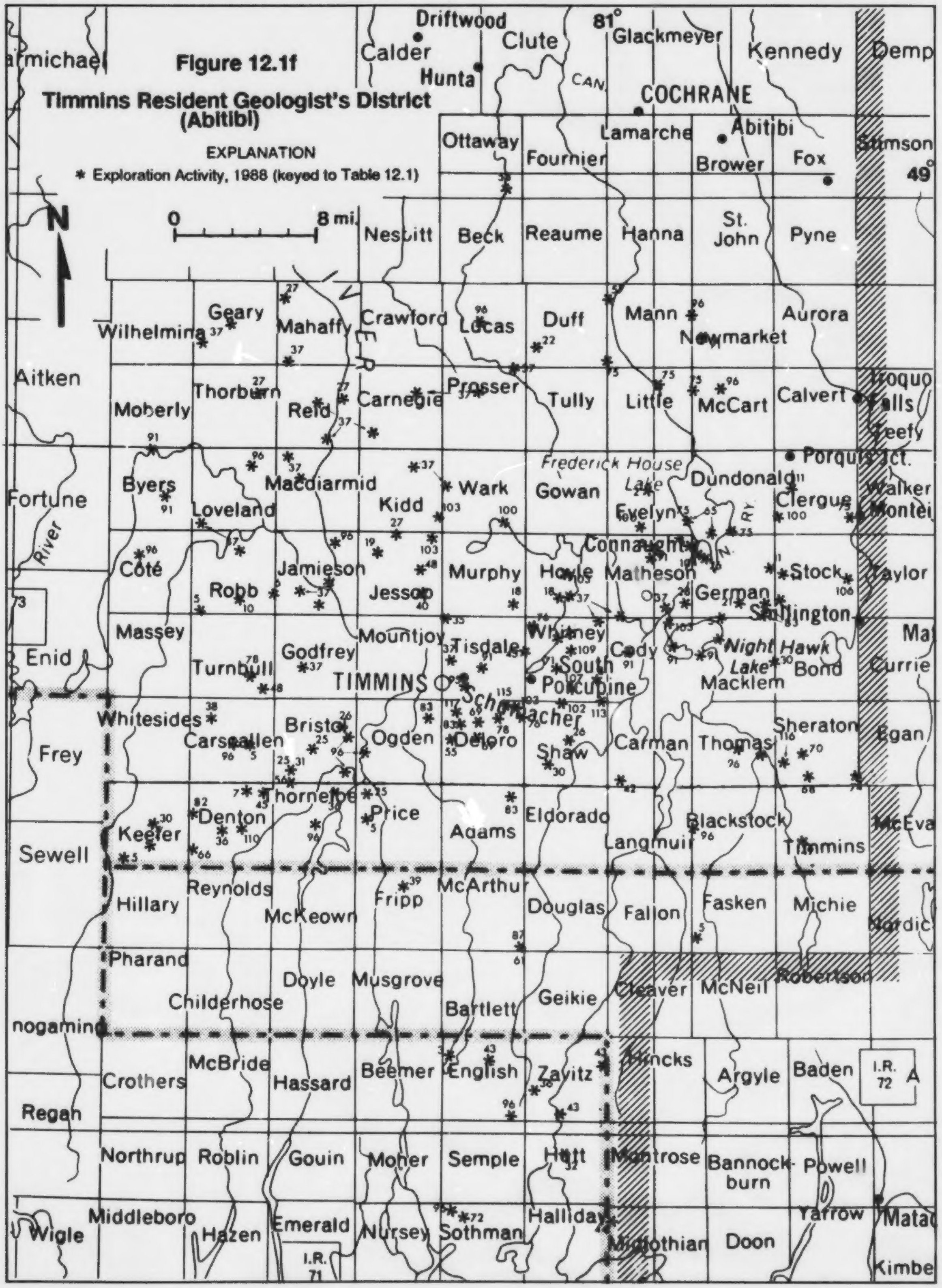

Figure 12.1f

Timmins Resident Geologist's District (Abitibi)

EXPLANATION

* Exploration Activity, 1988 (keyed to Table 12.1)

N
0
8 mi.
81°
49°
Driftwood
Calder
Hunta
Clute
Glackmeyer
Kennedy
COCHRANE
Ottaway
Fournier
Lamarche
Abitibi
Brower
Fox
Stimson
Nesbitt
Beck
Reaume
Hanna
St. John
Pyne
Wilhelmina
Geary
Mahaffy
Crawford
Lucas
Duff
Mann
Newmarket
Aurora
Aitken
Moberly
Thorburn
Reid
Carnegie
Prosser
Tully
Little
McCart
Calvert
Iroquois Falls
Porquis Jct.
Fortune
Byers
Macdiarmid
Kidd
Wark
Gowan
Frederick House Lake
Dundonald
Evelyn
Clergue
Walker
Loveland
River
Cote
Jamieson
Robb
Jessop
Murphy
Hoyle
Connaught
Matheson
German
Stock
Taylor
Schumacher
Massey
Mountjoy
Tisdale
Whitney
South Porcupine
Cody
Night Hawk Lake
Bond
Currie
Shillington
Enid
Turnbull
Godfrey
TIMMINS
Macklem
Frey
Whitesides
Carscallen
Bristol
Ogden
Deloro
Shaw
Carman
Thomas
Sheraton
Egan
Sewell
Keefer
Denton
Thorneloe
Price
Adams
Eldorado
Langmuir
Blackstock
Timmins
McEvay
Hillary
Reynolds
McKeown
Fripp
McArthur
Douglas
Fallon
Fasken
Michie
Nordica
Pharand
Childerhose
Doyle
Musgrove
Bartlett
Geikie
Cleaver
McNeil
Robertson
Kenogamind
Crothers
McBride
Hassard
Beemer
English
Zavitz
Hincks
Argyle
Baden
I.R. 72
Regan
Northrup
Roblin
Gouin
Moher
Semple
Hutt
Montrose
Bannockburn
Powell
Wigle
Middleboro
Hazen
Emerald
Nursey
Sothman
Halliday
Midlothian
Doon
Yarrow
Kimberly
I.R. 71

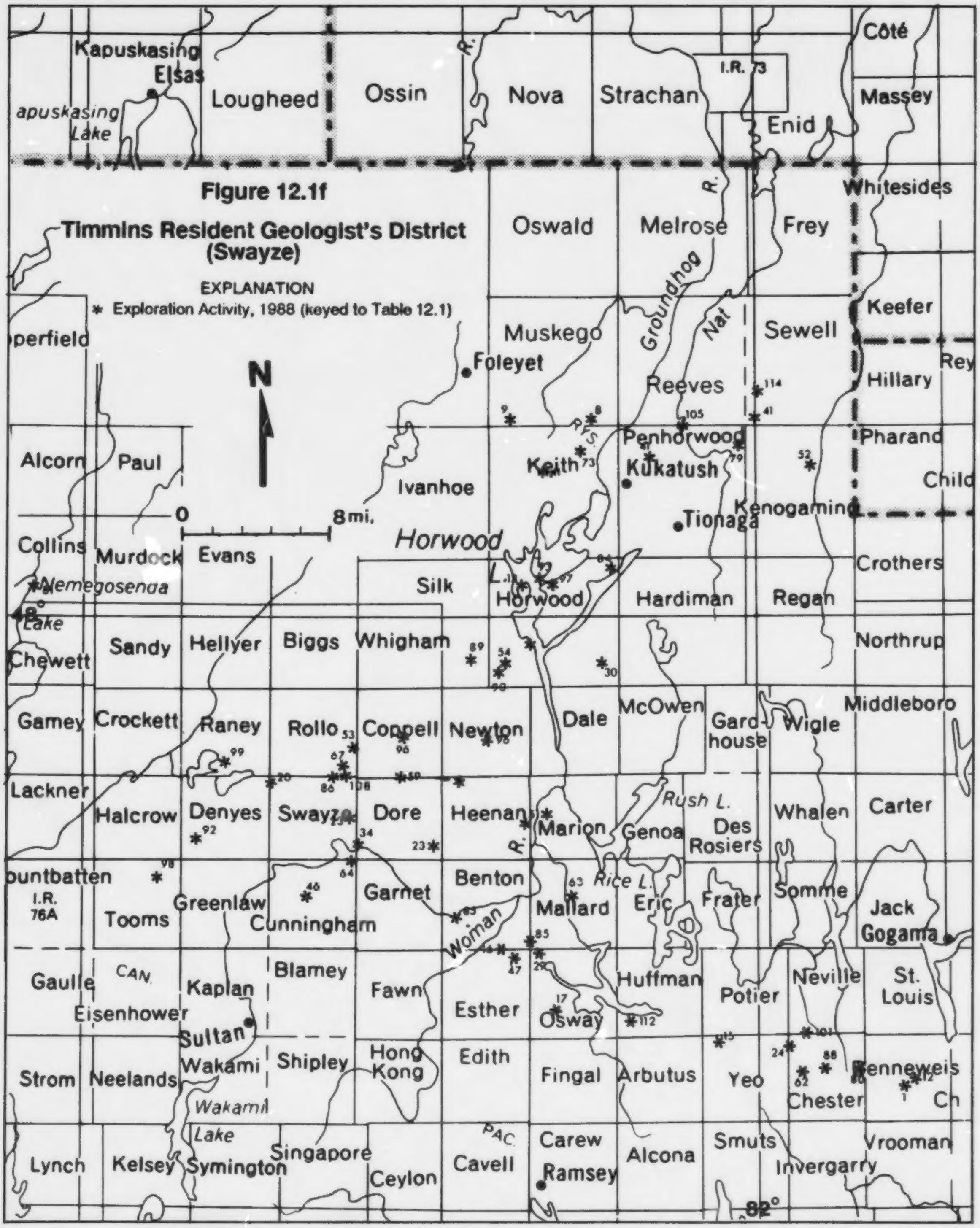

Figure 12.1f

Timmins Resident Geologist's District (Swayze)

EXPLANATION

* Exploration Activity, 1988 (keyed to Table 12.1)

N
0
8 mi.
Kapuskasing
Elsas
apuskasing Lake
Lougheed
Ossin
Nova
Strachan
I.R. 73
Enid
Côté
Massey
Whitesides
Oswald
Melrose
Frey
Groundhog
Nat
R.
Keefer
Sewell
Muskego
Foleyet
Reeves
Hillary
Rey
Pharand
Child
pperfield
Alcorn
Paul
Ivanhoe
Keith
Penhorwood
Kukatush
Tionaga
Kenogaming
Collins
Murdock
Evans
Horwood
Silk
Horwood L.
Hardiman
Regan
Crothers
Nemegosenda Lake
Chewett
Sandy
Hellyer
Biggs
Whigham
Northrup
Gamey
Crockett
Raney
Rollo
Connell
Newton
Dale
McOwen
Gardhouse
Wigle
Middleboro
Lackner
Halcrow
Denyes
Swayze
Dore
Heenan
Marion
Genoa
Rush L.
Des Rosiers
Whalen
Carter
ountbatten
I.R. 76A
Tooms
Greenlaw
Cunningham
Garnet
Benton
Mallard
Rice L.
Eric
Frater
Somme
Jack
Gogama
Woman
Gaulle
CAN.
Eisenhower
Kaplan
Blamey
Fawn
Esther
Osway
Huffman
Potier
Neville
St. Louis
Sultan
Strom
Neelands
Wakami
Wakami Lake
Shipley
Hong Kong
Edith
Fingal
Arbutus
Yeo
Chester
Penneweis
Ch
Lynch
Kelsey
Symington
Singapore
Ceylon
PAC.
Cavell
Carew
Ramsey
Alcona
Smuts
Invergarry
Vrooman
82°
1
8
9
17
20
23
24
29
30
34
41
46
47
52
53
54
58
59
62
63
64
67
73
79
80
84
85
86
88
89
90
92
96
97
98
99
101
105
108
112
114
115

TABLE 12.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Actuate Resources	Benneweis--linecutting, magnetic survey
2	Allerston, R.A.	Evelyn--magnetic survey
3	American Barrick	English, Beemer--geological and airborne and ground geophysical surveys, diamond drilling
4	Arsenault, J.	Slack--stripping, trenching, manual and mechanical work
5	Asarco Exploration	Macklem, German--diamond drilling Carscallen, Fallon, Fasken--overburden drilling Robb, Fallon, Fasken--trenching Keefer, Price--geophysical surveys Matheson--induced polarization survey
6	Aslan Exploration/Development	Robb, Jamieson--diamond drilling, geophysical surveys
7	Aumo Exploration	Denton--diamond drilling
8	BHP-Utah Mines	Whitney--geological and geophysical surveys Keith, Muskego--geochemical and induced polarization surveys
9	B.P. Canada	Keith, Muskego--induced polarization survey, diamond drilling
10	Barnes, R.T.J./Morgan, C.	Robb--magnetic and very low frequency (VLF) electromagnetic surveys
11	Beardmore Resources	German, Stock--airborne magnetic and very low frequency (VLF) electromagnetic surveys
12	Blue Falcon Mines	Benneweis--geological survey
13	Bongold/Giant Bay	Horwood--diamond drilling
14	Brightwest Resources	Stock--magnetic and VLF electromagnetic surveys, overburden drilling
15	Bryndon Ventures	Yeo--overburden geochemical survey
16	Burton, M.L.	Esther, Benton--diamond drilling
17	Canadian Gold Resources	Osway--diamond drilling
18	Canamax Resources	Hoyle, Murphy--diamond drilling
19	Canhorn Mining	Jessop--geological, magnetic and VLF electromagnetic surveys
20	Can Mac Exploration	Scholfield, Talbott--stripping, trenching, diamond drilling Swayze, Denyes--stripping, trenching, diamond drilling, airborne magnetic and VLF electromagnetic surveys, geological survey
21	Card Lake Resources	German--diamond drilling
22	Central Crude Limited	Duff--magnetic and horizontal loop electromagnetic surveys
23	Charet Syndicate	Swayze, Dore--airborne magnetic and VLF electromagnetic surveys, linecutting, geological survey
24	Chesbar Resources	Chester, Yeo--diamond drilling
25	Chevron Canada Resources	Bristol--stripping, geological and geochemical surveys Price--diamond drilling, trenching and geological survey
26	Cominco Limited	Bristol, German, Shaw--diamond drilling Whitney--bulk sampling, beneficiation tests
27	Comstate Resources	Reid, Thorburn--geological, magnetic and horizontal loop electromagnetic surveys Jessop--geological survey Mahaffy--geological survey
28	Consolidated Rio Plata	Matheson--linecutting, magnetic, gradiometric and VLF electromagnetic surveys, diamond drilling
29	Consolidated Silver Butte	Osway--VLF electromagnetic survey, stripping, diamond drilling
30	Continental Precious Minerals	Bond, Macklem, Keefer, Shaw--magnetic and VLF electromagnetic surveys Horwood--linecutting, magnetic and VLF electromagnetic surveys Tolmie--magnetic survey
31	Croxall, J.	Bristol--exploration
32	Decker, A.	Hutt--linecutting, stripping, trenching
33	Dore Exploration	Lower Detour Lake--VLF electromagnetic survey
34	Dore Norbaska Resources	Swayze, Dore--linecutting, magnetic and VLF electromagnetic surveys
35	Ellies, B.A.	Tisdale--packsack drilling
36	Esso Minerals	Thorneloe, Denton--diamond drilling English, Zavitz--geological and induced polarization surveys, stripping, sampling
37	Falconbridge Limited	Carnegie--diamond drilling, magnetic, radiometric, VLF and horizontal loop electromagnetic surveys Cody--diamond drilling and horizontal loop electromagnetic survey Geary, Macdiarmid, Prosser, Reid--diamond drilling, magnetic and horizontal loop electromagnetic surveys

TABLE 12.1 Continued

Number on Figure	Individual or Company	Activity
37	Falconbridge Limited (con't.)	Godfrey, Hoyle, Kidd, Loveland, Mahaffy, Matheson, Tisdale, Wark, Whitney--diamond drilling Jamieson--diamond drilling, magnetic, VLF and horizontal loop electromagnetic surveys Robb--magnetic, VLF and horizontal loop electromagnetic surveys
38	FinNeth Exploration	Carscallen--diamond drilling
39	Garneau, R.	Fripp--airborne magnetic and VLF electromagnetic surveys
40	Glen Auden Resources	Lower Detour Lake--overburden drilling, induced polarization survey Jessop--linecutting, diamond drilling, magnetic and horizontal loop electromagnetic surveys
41	Glen Auden/Goldrock	Keith, Penhorwood--airborne magnetic and electromagnetic surveys Kenogaming, Penhorwood, Reeves, Sewell--geological, geochemical and magnetic surveys, trenching, stripping, sampling
42	Golden Pheasant Resources	Carman, Langmuir--diamond drilling, linecutting, geological, magnetic and induced polarization surveys
43	Goldfields Canadian Mining	Tisdale, Whitney--geological and geochemical surveys, diamond drilling English, Zavitz, Hutt--geological and geochemical surveys, stripping, trenching
44	Goldtech Mines	Halliday--diamond drilling
45	Gowest Amalgamated/Jonpol	Denton--diamond and overburden drilling
46	Grand American Minerals	Cunningham--geological, magnetic, horizontal loop electromagnetic and lithogeochemical surveys
47	Grandad Resources	Esther--diamond drilling
48	Granges Exploration	Turnbull, Jessop--diamond drilling
49	Guenther, P.	Timmins--trenching, magnetic survey
50	HSK Minerals/Homestake	Doherty, Pelletier--diamond drilling and surface exploration
51	Halex Resources	Marion, Heenan and Genoa--induced polarization survey, diamond drilling
52	Halley/Surf Inlet	Kenogaming--diamond drilling
53	Hanson Lake Explorations	Rollo--magnetic and VLF electromagnetic surveys, diamond drilling
54	Hardiman Bay Resources	Horwood--geological and geophysical surveys
55	Harvey, F./Martin, W.	Deloro--stripping, sampling, manual and mechanical work
56	Highwood Resources	Bristol--diamond drilling, trenching
57	Hill, L.	Mann--diamond drilling
58	Homestake Consulting	Fournier, Ottaway--magnetic and VLF electromagnetic surveys
59	Hopkins, A.	Dore, Heenan--airborne magnetic and VLF electromagnetic surveys
60	Hutchison Resources	Scholfield--magnetic and horizontal loop electromagnetic surveys
61	Inco Gold	McArthur, Bartlett--geological and geophysical surveys
62	Isaac Burns Metals	Chester--stripping, sampling
63	Jarvis Resources	Mallard--diamond drilling
64	Jones, D.	Cunningham--magnetic survey
65	Kangeld Resources	Evelyn, German, Dundonald--overburden drilling
66	Keefer Lake	Denton--magnetic and VLF electromagnetic surveys, stripping Keefer--magnetic, VLF electromagnetic and geochemical surveys
67	Kenty Explorations	Rollo--magnetic and induced polarization surveys, diamond drilling
68	Ressources Kimex	Timmins, Sheraton--linecutting, magnetic and VLF electromagnetic surveys
69	Kingswood Exploration	Deloro--linecutting, stripping, magnetic and geological surveys
70	Lac Minerals	Sheraton--linecutting, VLF electromagnetic survey
71	Lithium Corporation	Whitney--sampling, diamond drilling, geological, magnetic and VLF electromagnetic surveys
72	Manville Canada	Sothman--trenching, sampling
73	Marshall Minerals/Gail Resources	Keith--linecutting, sampling, diamond drilling, stripping, trenching, geological and geophysical surveys
74	McAllister, T.	Timmins, Sheraton--magnetic and VLF electromagnetic surveys
75	McKinnon Prospecting	Casselman, Slack, Auden, Hurdman, Beardmore, Alexandra, Machin, Pitopiko River, Fauquier, Shackleton, Valentine, Kilmer, German, Evelyn, Clergue, Matheson, Little, Mann, McCart--airborne magnetic and VLF electromagnetic surveys
76	Mill City Gold	Shaw, Deloro--linecutting, magnetic, VLF electromagnetic and induced polarization surveys, diamond drilling Whitney--linecutting, geophysical survey, overburden drilling
77	Miller, W.	Foch--stripping

TABLE 12.1 Continued

Number on Figure	Individual or Company	Activity
78	C. Morgan	Deloro--magnetic and VLF electromagnetic surveys Turnbull--trenching, sampling
79	Morin, D.A.	Penhorwood--stripping, manual work
80	Murgold Resources	Chester, Benneweis--linecutting, geophysical surveys
81	Musto Explorations	Collins, Chewett--sampling
82	Newmont Exploration	Denton, Keefer--diamond drilling, magnetic and VLF electromagnetic surveys
83	Noranda Exploration	Adams, Deloro, German, Macklem, Stock, Fox River, Pivabiska River, Renesig Creek, Lower Detour Lake--diamond drilling Ogden--diamond drilling, magnetic and VLF electromagnetic surveys
84	Noranda/Anglo Porcupine	Horwood--geochemical and magnetic surveys
85	Noront/Central Crude	Benton, Esther, Osway--exploration
86	Northern Resources	Swayze--airborne magnetic and VLF electromagnetic surveys
87	Norwin Resources	McArthur, Bartlett--airborne magnetic and VLF electromagnetic surveys
88	Odyssey/Canorth	Chester--diamond drilling
89	652422 Ontario Inc.	Silk--diamond drilling, magnetic, VLF electromagnetic and induced polarization surveys
90	Orofino Resources	Horwood--diamond drilling
91	Pamorex Minerals	Cody, Macklem--overburden drilling, trenching, sampling Tisdale, Matheson--diamond drilling Byers, Moberly, Newmarket--linecutting, geophysical surveys
92	Patrie Property	Denyes--linecutting, geophysical and geological surveys
93	Pelangio-Larder Mines	Horwood--magnetic and VLF electromagnetic surveys
94	Penttinen, J.W.	Casselman--geological survey
95	Peter Island Resources	Tisdale--diamond drilling
96	Placer Dome	Bristol--diamond drilling, magnetic survey Ogden--magnetic and induced polarization surveys, diamond drilling Thomas--diamond drilling, geology, sampling Sothman, Nursey--diamond drilling Langmuir, Blackstock--diamond drilling, induced polarization survey English, Semple--induced polarization survey Newmarket, Carscallen, Lucas, McCart, Cote, Loveland, Jamieson, Thorneloe--linecutting, geophysics Newton, Coppell--diamond drilling, geological and geochemical surveys, stripping, trenching
97	Plum Resources	Horwood, Williamson--magnetic and VLF electromagnetic surveys
98	Quinterra Resources	Tooms--diamond drilling
99	Raney Minerals	Raney--diamond drilling, magnetic survey
100	Salo, A.J.	Evelyn, Matheson, Clergue, Wark--airborne magnetic and VLF electromagnetic surveys
101	Seaway Base Metals	Chester--airborne magnetic and VLF electromagnetic surveys
102	Seeley Lake	Shaw--diamond drilling
103	Sheridan Geophysics	Deloro, Wark--stripping Cody--stripping, trenching Hoyle--magnetic and electromagnetic surveys Jessop--magnetic survey Kidd--stripping, magnetic and horizontal loop electromagnetic surveys
104	Smith, R.G.	German--magnetic and horizontal loop electromagnetic surveys McCowan--diamond drilling
105	Steetley Industries	Penhorwood--diamond drilling
106	Stockgold Resources	Stock--diamond drilling
107	Sutherland, H.	Whitney--geological survey
108	Swayze Resources	Swayze--magnetic survey
109	Syngold/Platinova	Whitney--diamond drilling
110	TME / Esperanto	Denton--induced polarization and VLF electromagnetic surveys, stripping, trenching, overburden sampling
111	Tarzan Gold	Clergue--magnetic survey

TABLE 12.1 Continued

Number on Figure	Individual or Company	Activity
112	Tonopah/Telstar	Huffman--diamond drilling
113	Total Energold	Shaw, Whitney--linecutting, overburden sampling, geological, magnetic, VLF and horizontal loop electromagnetic surveys
114	Tremblay, R.	Sewell--trenching, sampling
115	Tyranex Gold	Deloro--magnetic and VLF electromagnetic surveys
116	Ventex Energy	Thomas, Sheraton--VLF electromagnetic and geological surveys
117	Weir, L.	Deloro--stripping, trenching
118	Westmin Resources	Lower Detour Lake--VLF electromagnetic survey

TABLE 12.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	5,867	6,117	34,553	119,758	325,685	17,260	532,820
1987	8,934	4,402	34,474	120,384	612,631	32,001	807,277
1986	17,889	8,689	33,181	129,932	481,547	26,266	717,522
1985	6,052	10,024	23,207	131,330	278,881	34,032	503,338
1984	7,633	11,040	27,179	140,864	495,323	51,723	738,038
1983	11,859	4,967	30,586	128,126	199,892	44,755	407,161
1982	5,420	6,457	23,694	91,203	359,970	36,178	596,097
1981	8,934	2,934	24,731	114,823	261,301	23,177	471,827
1980	10,742	1,778	18,753	59,993	212,208	5,246	296,852
1979	3,975	2,504	9,597	40,850	59,605	5,480	151,003
1978	3,623	4,429	8,126	38,056	47,333	1,880	94,045
1977	2,438	4,336	8,932	77,496	135,134	3,755	228,090
1976	5,837	3,621	10,830	25,819	43,920	2,140	97,258
1975	4,162	4,142	8,614	83,388	108,420	1,300	200,034
1974	3,456	3,692	7,594	69,341	52,128	3,146	142,136
1973	2,258	3,728	6,460	58,495	50,022	2,500	114,917
1972	2,980	3,509	7,939	55,900	89,560	(1,400)	149,387
1971	3,840	3,708	(8,500)	52,401	131,385	1,050	195,457
1970	3,903	3,916	(8,600)	96,946	59,013	5,560	167,465
1969	3,482	3,687	(8,700)	86,397	53,497	1,188	143,303
1968	3,935	4,906	(9,000)	42,575	26,656	2,852	74,580
1967	2,944	8,356	(9,800)	79,634	32,220	871	117,299
1966	5,724	10,352	(15,250)	151,747	65,577	(5,000)	227,732
1965	47,900	9,922	(19,000)	242,869	224,959	(6,500)	486,246
1964	20,823	931	(25,000)	48,095	93,863	(1,000)	146,633
1963	1,971	1,326	(5,250)	34,328	2,348	(200)	40,370
1962	1,440	1,425	(4,500)	(19,000)	(10,000)	(3,200)	(35,000)
1961	1,443	1,578	(4,500)	(20,000)	(8,000)	(500)	(30,000)
1960	1,321	2,296	(4,750)	(21,000)	(9,000)	(1,400)	(39,000)
1959	2,247	1,803	(5,600)	(20,000)	(5,000)	(300)	(30,000)
1958	1,451	2,147	(5,280)	(17,000)	(4,000)	(3,000)	(30,000)
1957	2,456	2,440	(5,800)	(18,000)	(2,000)	(400)	(25,000)
1956	1,536	958	(5,800)	(25,000)	(10,000)	(4,500)	(45,000)
1955	1,793	757	(5,250)	(4,000)	(3,000)	(1,500)	(10,000)

Brackets indicate approximate figures.

leased in 1989. Figures published in 1988 gave proven and probable reserves down to the 5000-foot level of 50 600 000 t with a grade of 3.55 percent copper, 5.11 percent zinc, 0.15 percent lead, and 62 g/t silver. Ore reserves are equivalent to about 17 years of production at planned operating rates.

The company is planning to sink a No. 3 internal shaft to access ore to 7000 feet below surface.

The bottom level at the No. 1 Mine is 2500 feet, where two stopes are currently being mined. During 1988, there were 29 stopes mined in the No. 1 Mine with 10 to 12 stopes operating at any one time.

The bottom level at the No. 2 Mine is 4600 feet, where one stope is currently being mined. During 1988, there was a total of 16 stopes mined in the No. 2 Mine; at any one time there were five to six stopes operating. Falconbridge Limited has started using electric 50-ton trucks for hauling ore from the 4600-foot level to the 4400-foot, level where it is dumped into the ore pass. Eventually, these electric trucks will be used below the 4600-foot level instead of diesel-powered trucks, to avoid ventilation problems.

The Kidd Creek copper smelter was used to refine approximately 10 000 tons of copper concentrate from the company's Strathcona Mine in Sudbury. The company received 2323 t of silica from the Roseval Silica operations in Penhorweed Township on a trial basis, for use as flux.

At the end of 1988, there were 2544 people employed by Falconbridge Limited's Kidd Creek operations. This number includes 137 people employed by the gold division (Falconbridge Limited, personal communication, 1988; Falconbridge Limited, Annual Report, 1987).

TABLE 12.3. GOLD PRODUCTION FROM THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1987).

MINE NAME	TOWNSHIP	YEARS OF PRODUCTION	TONS MILLED	OZ. PRODUCED	GRADE
Ankerite	Deloro	1926-1953,-78	4,993,929	957,292	0.19
Ankerite/March	Deloro	1926-1935	317,769	61,039	0.19
Aquarius	Macklem	1984	32,000	7,200	0.225
Aunor (Pamour No. 3)	Deloro	1940-1984	8,482,174	2,502,214	0.30
Banner	Whitney	1927-28,-33,-35	315	670	2.13
Bell Creek	Hoyle	1987-	55,180	9,558	0.235
Bonetal	Whitney	1941-1951	352,254	51,510	0.15
Bonwhit	Whitney	1951-54	200,555	67,940	0.34
Broulan	Whitney	1939-53	1,146,059	243,757	0.21
Cincinnati	Deloro	1922-1924	3,200	736	0.23
Concordia	Deloro	1935	230	16	0.07
Coniaurum/Carium	Tisdale	1913-18, 1928-1961	4,464,006	1,109,574	0.25
Crown	Tisdale	1913-1921	226,180	138,330	0.61
Davidson	Tisdale	1918-1920	9,341	2,438	0.26
Delnite	Deloro	1937-1964	3,847,364	920,404	0.20
(open pit)	Deloro	1987	49,567	3,134	0.77
DeSantis	Ogden	1933,1939-42, 1961-1964	196,928	35,842	0.18
DeSantis	Turnbull	1926		13	
Detour Lake Mine	Sunday Lake	1983-	3,359,000	300,691	0.10
Dome	Tisdale	1910-	44,206,914	11,454,071	0.27
Faymar	Deloro	1940-1942	119,181	21,851	0.18
Fuller	Tisdale	1940-1944	44,028	6,566	0.15
Gillies Lake	Tisdale	1929-31,35-37	54,502	15,278	0.28
Goldhawk	Cody	1947	636	53	0.08
Golhawk (open pit)	Cody	1980	40,000	3967	0.10
Halcrow-Swayze	Halcrow	1935	211	40	0.19
Hallnor (Pamour No. 2)	Whitney	1938-68,-81	4,226,419	1,645,892	0.39
Hollinger--Schumacher	Tisdale	1915-1918	112,124	27,182	0.24
Hollinger (Pamour Timmins)	Tisdale	1910-1968,	65,778,234	19,327,691	0.29
		1976-	2,452,344	171,774	0.07
Hoyle	Whitney	1941-44,46-49	725,494	71,843	0.10
Hoyle Pond	Hoyle	1985-	287,420	151,550	0.61
Hugh-Pam	Whitney	1926,1948-65	636,751	119,604	0.19
Jerome	Osway	1941-43,1956	335,060	56,893	0.17
Joburke	Keith	1973-75,79-81	440,117	43,571	0.10
Kingbridge/Gomak	Chester	1935-36	1,387	98	0.07
McIntyre (Pamour Schumacher)	Tisdale	1912-	37,529,691	10,745,361	0.29
McLaren	Deloro	1933-37	876	201	0.23
Moneta	Tisdale	1938-1943	314,829	149,250	0.47
Naybob	Ogden	1932-1964	304,100	50,731	0.17
Owl Creek	Hoyle	1981-	1,358,812	169,960	0.12
Pamour No. 1 (inc. #3 Pit)	Whitney	1936-	31,807,685	3,235,833	0.11
Paymaster	Tisdale	1915-1966	5,607,402	1,192,206	0.21
Porcupine Lake/Hunter	Whitney	1937-40,1944	10,821	1,369	0.13
Porcupine Peninsular	Cody	1924-27,-40,-47	99,688	27,354	0.27
Preston	Tisdale	1938-1968	6,284,405	1,539,355	0.24
Preston N Y	Tisdale	1933	2,800	153	0.05
Preston/Porcupine Pet	Deloro	1914-1915		314	
Preston/Porphyry Hill	Deloro	1913-1915	46	312	6.78
Reef Mine	Whitney	1915-1965	2,144,507	498,932	0.23
Tionaga/Smith-Thorne	Horwood	1938-1939	6,653	2,299	0.35
Tisdale Ankerite	Tisdale	1952	14,655	2,236	0.15
Tommy Burns/Arcadia	Shaw	1917	21	14	0.28-0.34
Vipond	Tisdale	1911-1941	1,565,218	414,367	0.26
TOTAL NO. OF MINES:	51				
			234,249,082	57,588,969	

BASE METAL PRODUCTION: TIMMINS RESIDENT GEOLOGIST DISTRICT (TO THE END OF 1987)

Mine	Township	Dates	Ore Milled (Tonnes)	%Cu	%Zn	%Ni	Ag (G/Tonne)	Au
Alexo	Dundonald	1912-19 1943-44	51 529	0.07		3.93		
Canadian Jamieson	Godfrey	1966-71	434 409	2.39	4.05			
Jameland	Jamieson	1969-72	461 805	0.99	0.88		3.5	0.05
Kam Kotia	Robb	1943-44 1961-72	6 007 194	1.09	1.03		3.5	0.05
Kidd Creek Mine	**Kidd**	**1965-**	**76 700 000**	**1.99**	**7.54**		**144.0**	
Langmuir	Langmuir	1973-77	997 903			1.5		
McIntyre	Tisdale	1963-81	10 162-640	0.62			0.09	0.023
United Obalski	Godfrey	1965-66	Data Unavailable					

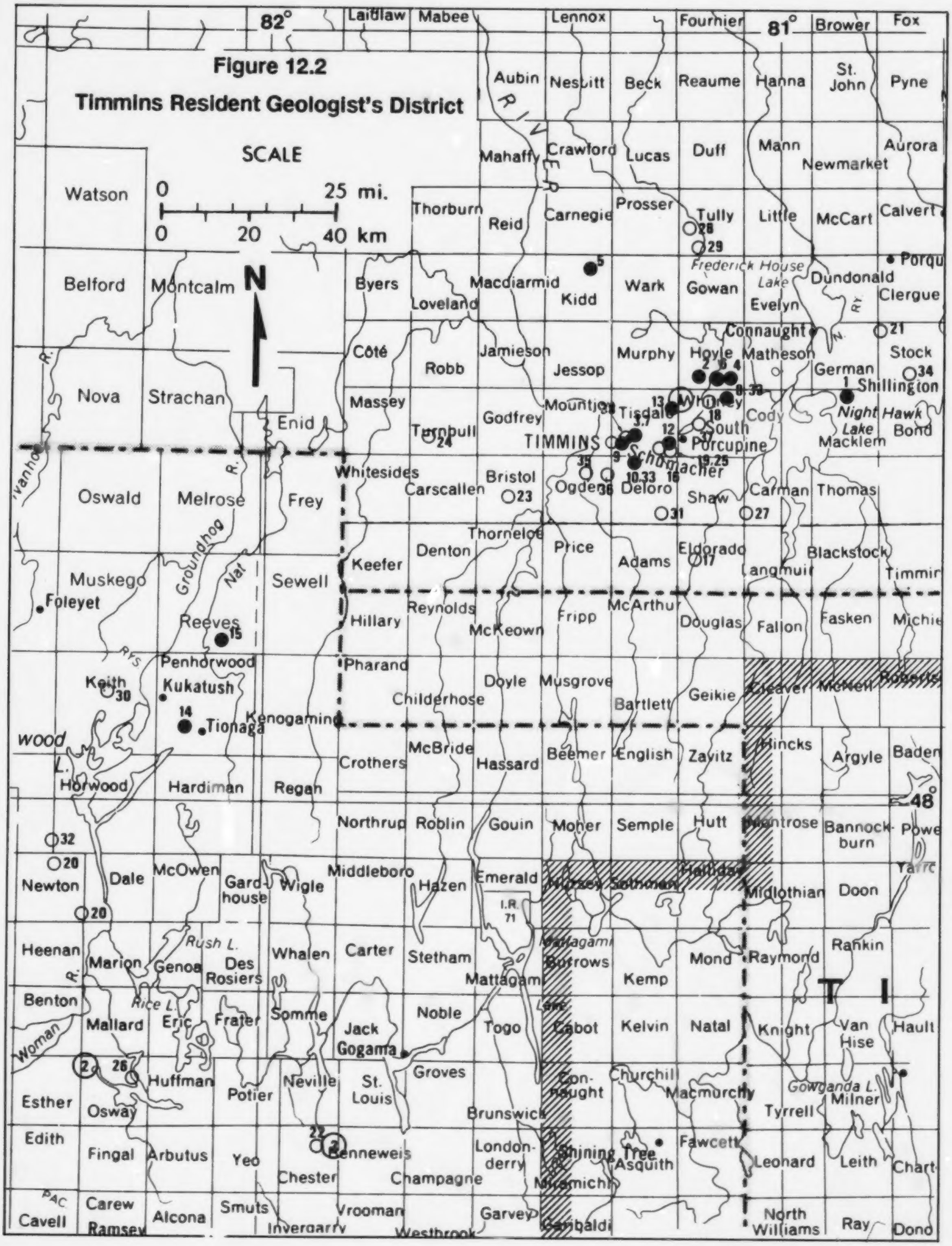

Figure 12.2
Timmins Resident Geologist's District

SCALE
0 25 mi.
0 20 40 km
N
82°
81°
48°
Laidlaw
Mabee
Lennox
Fournier
Brower
Fox
Aubin
Nesbitt
Beck
Reaume
Hanna
St. John
Pyne
Mahaffy
Crawford
Lucas
Duff
Mann
Newmarket
Aurora
RIVER
Watson
Thorburn
Reid
Carnegie
Prosser
Tully
Little
McCart
Calvert
Belford
Montcalm
Byers
Loveland
Macdiarmid
Kidd
Wark
Gowan
Frederick House Lake
Evelyn
Dundonald
Porqu
Clergue
Nova
Strachan
Côté
Robb
Jamieson
Jessop
Murphy
Hoyle
Connaught
Matheson
German
Stock
Shillington
Enid
Massey
Turnbull
Godfrey
Mountjoy
Tisdale
Whitney
Cody
Night Hawk Lake
Bond
TIMMINS
South Porcupine
Macklem
Schumacher
Oswald
Melrose
Frey
Whitesides
Carscallen
Bristol
Ogden
Deloro
Shaw
Carman
Thomas
Groundhog R.
Ivanhoe R.
Nat
Keefer
Denton
Thorneloe
Price
Adams
Eldorado
Langmuir
Blackstock
Timmins
Muskego
Foleyet
Sewell
Reeves
Hillary
Reynolds
McKeown
Fripp
McArthur
Douglas
Fallon
Fasken
Michie
Penhorwood
Kukatush
Keith
Tionaga
Kenogaming
Pharand
Childerhose
Doyle
Musgrove
Bartlett
Geikie
Cleaver
McNeil
Roberts
Wood L.
Horwood
Hardiman
Regan
Crothers
McBride
Hassard
Beemer
English
Zavitz
Hincks
Argyle
Baden
Northrup
Roblin
Gouin
Moher
Semple
Hutt
Montrose
Bannockburn
Powe
Newton
Dale
McOwen
Gardhouse
Wigle
Middleboro
Hazen
Emerald
Nursey
Sothman
Halliday
Midlothian
Doon
Yarro
I.R. 71
Heenan
Marion
Genoa
Rush L.
Des Rosiers
Whalen
Carter
Stetham
Mattagami
Mattagami Lake
Burrows
Kemp
Mond
Raymond
Rankin
Benton
Rice L.
Mallard
Eric
Frater
Somme
Jack
Gogama
Noble
Togo
Cabot
Kelvin
Natal
Knight
Van Hise
Hault
T I
Woman R.
Huffman
Potier
Neville
St. Louis
Groves
Connaught
Churchill
Macmurchy
Gowganda L.
Milner
Tyrrell
Esther
Osway
Brunswick
Edith
Fingal
Arbutus
Yeo
Chester
Benneweis
Champagne
Londonderry
Shining Tree
Asquith
Fawcett
Leonard
Leith
Chart
Cavell
Carew
Ramsey
Alcona
Smuts
Invergarry
Vrooman
Westbrook
Garvey
Garibaldi
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● Producing Mines 1988

1. Asarco Exploration Company of Canada Ltd., Aquarius Mine .... Au
2. Canamax Resources Inc., Bell Creek Mine ... Au
3. ERG Resources Inc. .... Au

Falconbridge Limited (4, 5, 6):

4. Hoyle Pond Mine .... Au
5. Kidd Creek Mine ..... Cu, Zn, Ag, Pb, Cd, Sn, In
6. Owl Creek Mine .... Au

Giant Yellowknife Mines Limited (7, 8, 9, 10):

7. Schumacher Division .... Au, Ag
8. Number 1 Mine and Number 3 Pit .... Au, Ag
9. Timmins Property .... Au, Ag
10. Delnite Property .... Au

Placer Dome Incorporated (11, 12):

11. Detour Lake Mine .... Au
12. Dome Mine .... Au
13. Total Energold Corporation, Davidson Mine ... Au
14. Roseval Silica Inc. .... Si
15. Steetley Talc Ltd. .... talc

2○ Advanced Exploration and Development Projects 1988 (Au)

16. Associated Porcupine Mines Ltd. — American Reserve Mining Corp.
17. BHP-Utah Mines Limited
18. Belmoral Mines Limited — Broulan Resources — Wrightbar Mines Limited
19. Belmoral Mines Limited — Vedron Limited
20. Breakwater Resources Limited
21. Canamax Resources Incorporated — Bruneau Mining Corporation
22. Chesbar Resources Incorporated — Murgold Resources Incorporated
23. Chevron Canada Resources — Holmer Gold Mines Limited
24. Delbridge Mines Limited
25. Diepdaume Mines Limited
26. Jerome Gold Mines Corporation — Muscocho Explorations Limited
27. Marshall Minerals Corporation
28. New Texmont Explorations Limited
29. Noranda Exploration Company Limited — Golden Princess Mining Corp.
30. Noranda Exploration Company Limited — Tarzan Gold Incorporated
31. Northfield Minerals Incorporated — Orcana Resources Limited — Morgain Minerals Incorporated
32. Orofino Resources Limited
33. Pamorex Minerals Incorporated
34. St. Andrew Goldfields Limited
35. Stan West Mining Corporation — Canacord Resources Incorporated — Noranda Exploration
36. Victoria Porcupine Resources
37. Wabigoon Resources Incorporated — Master Resources and Development

① Location of OGS Field Party in 1988

1. Geology of Tisdale and Northern Whitney Townships, D.W. Piroshco and K. Kettles
2. Geological Setting of Gold Mineralization in the Southern Swayze Belt, G.M. Siragusa

PRECIOUS METALS

Asarco Exploration Company of Canada Limited, Aquarius Mine

The Aquarius Mine went into production in January 1988, and, to the end of 1988, had processed 68 000 tons of ore at a recovered mill grade of 0.16 ounce gold per ton. An estimated 20 000 tons of the ore milled was from 1984 stockpiles. Projected production for 1989 is 68 000 tons at a slightly higher grade. Production during 1988 was from nine stopes in the northern end of the mine. Eight of the stopes were in carbonatized ultramafic rocks, and one was in a felsic intrusion. All stopes were located above the 166 m sublevel.

Most of the mining took place in developed areas north of the shaft, while exploration, diamond drilling, and horizontal development occurred south of the shaft. Vertical development at the mine totalled 100 m and horizontal development totalled 1000 m. It is estimated that 10 000 m of underground diamond drilling and 1100 m of surface diamond drilling will have been done at the mine site by the end of 1988.

During 1988, 80 people were employed on the project (Asarco Exploration Company of Canada Limited; Lake Asbestos of Quebec Ltd., personal communication, 1988).

Canamax Resources Incorporated, Bell Creek Mine

The Bell Creek Mine was put into commercial production on January 1, 1987. Production for 1987 was 55 180 tons of ore for a total output of 9558 ounces of gold. Although the 1988 figures were unavailable at the time of writing, it is estimated that 24 500 ounces of gold will have been recovered from 135 850 tons of ore milled, at an average recovered grade of 0.180 ounce gold per ton. All production came from the North 'A' Zone with the exception of 7700 tons which were developed ore from the Marlhill Zone.

In July 1988, Canamax Resources Incorporated purchased 50 percent of the Bell Creek Mine from Pamorex Minerals Incorporated for $16 500 000. Canamax now owns 100 percent of the mine. Pamorex retains a 2.5 percent net smelter royalty.

In 1988, raising in the mine totalled 500 m with lateral development of 1000 m. A total of 1400 m of underground diamond drilling was done at the Bell Creek Mine to further define the North 'B' Zone and the Bell Creek Zone.

On the eastern side of the North 'A' Zone, vertical sublevel retreat mining is taking place. This method will be phased out in 1989. The western side is being mined by the shrinkage method. Breaking was being done in three stopes while two stopes were being pulled empty. All mining after 1989 will be shrinkage mining with pillars being left between stopes. The bottom level is 240 m below surface and it is being stoped. The shaft bottom is 305 m below surface. Deep exploratory drilling will be done in 1989 from the 240 m level to explore the North 'A' Zone at depth. The Bell Creek Mill has a stated capacity of 385 tons per day. However, in the last few months of 1988, throughput was 407 tons per day.

In 1988, the ramp at the Marlhill Zone advanced from 75 m below surface to 100 m below surface. Lateral development, including ramping, totalled 1250 m in 1988. Raising totalled 250 m. Stope preparation (haulage drifts and draw points) was done on the M_1 Zone on both the 50 m and 100 m levels. The M_1 Zone contains most of the ore of the three zones at Marlhill, and development of this zone has been done at 50 m intervals. Development was done on the 25, 50, and 75 m levels of the M_2 Zone, and the 25, 50, and 100 m levels of the M_3 Zone (the 75 m level will be driven later). The ramp is expected to be driven to the 150 m level in 1989.

Development ore production at Marlhill totalled 11 750 tons of which 7700 tons were milled and the rest stockpiled. Proven and probable reserves on the North 'A' Zone and the Marlhill Zone are 730 000 tons at a grade of 0.189 ounce gold per ton. These reserves should increase after the deep exploratory drilling scheduled for 1989.

There are 92 people employed at the Bell Creek Mine (Canamax Resources Incorporated, personal communication, 1988; Annual Report 1987, News Release, September 1, 1988).

ERG Resources Incorporated

ERG Resources Incorporated, a subsidiary of Pamour Inc., is planning to treat 151 000 000 tons of gold–bearing mill tailings controlled by the company in the Timmins area. August 1988, saw the start–up of the project and approximately 400 000 tons of tailings were milled from start–up until the project was shut down for the winter in November. Tailings treated in 1988 came from current tailings from the Schumacher Mill, the McIntyre Dam, the Carium Dam, and minor amounts from the Gillies Basin. Gold production from the project in 1989, the first full year of production, is expected to be 100 000 ounces of gold and will exceed 400 000 ounces over the first six years of operation. The operating season of the project will be seven months a year at most, due to cold weather conditions. Tailings will be reclaimed at a rate of 250 000 t per month using high–pressure water monitors.

The project has been divided into two phases. During the first, which is to last until 1994, 50 200 000 t of tailings grading 0.52 g/t gold will be treated to produce 420 000 ounces of gold. The dams to be treated during Phase I include McIntyre Numbers 1 through 5, Coniaurum 1 and 2, Gillies

Lake tailings, and the McIntyre Ball Park tailings, all of which lie close to the new ERG concentrator. Phase II involves the laying of pipelines up to 15 km long to recover the more distant Pamour, Hallnor, Hollinger, Delnite, and Aunor dams. Gold recoveries of 30 to 78 percent, depending on head grades and metallurgical characteristics of individual dams, have been indicated by testing. Overall recovery in Phase I is estimated at 49 percent. The concentrator is designed to treat 1 200 000 t per month to allow for operational availability. This includes 1 000 000 t per month of old tailings plus 75 000 t per month of current Schumacher Mill tailings during the eight month operating season.

During the construction phase of the project, the work force consisted of 150 people. The permanent work force when the project is in production will be 50 people (ERG Resources Incorporated, information brochure, 1988; ERG Resources Incorporated, personal communication, 1988).

Falconbridge Limited, Hoyle Pond Mine

In 1988, the Hoyle Pond Mine produced 94 000 t of ore grading 17.5 g/t gold. Production consisted of 70 000 t from stope mining and 24 000 t of development ore.

Reserve figures are currently being recalculated for release in 1989. It is estimated that they will be slightly lower than 400 000 t at an average grade of 19 g/t gold as published in 1987.

Underground exploration diamond drilling totalled 81 000 feet at the mine in 1988. Of that total, 50 000 feet were drilled by contract drillers, with the remainder being completed using the company's own equipment. Results of the drilling indicated good potential and additional favourable horizons. Lateral underground development in 1988 totalled 1550 m, while vertical development totalling 775 m was completed. The current bottom level of the mine is the No. 4 level at a depth of 180 m. There are 12 cut–and–fill stopes currently in production, with an additional two stopes under development (Falconbridge Limited, personal communication, 1988).

Falconbridge Limited, Owl Creek Mine

Production at the Owl Creek Mine in Hoyle Township, to the end of 1988, has been estimated at 189 000 t grading 4.5 g/t gold. Original projections for 1988 were 220 000 t; however, the north wall of the pit failed and 250 000 tons of greywacke caved into the pit. Of the ore produced, 7556 t were processed at the Diepdaume gold mill. Of the remaining ore, 50 000 t were processed through the Falconbridge Mill, 35 000 t of high–silica ore were used as smelter flux, and the remainder of the ore was stockpiled. Plans for 1989 involve mixing the stockpiled ore with ore from Hoyle Pond for milling.

It has been estimated that the open pit mining of the Owl Creek deposit will be completed in 1989. Mining is currently taking place on the seventh bench, with mining on the eighth bench planned for 1989. The method to be used to mine ore on the ninth and tenth benches is dependent on exploration results, and may be done from underground.

Underground development of the deposit began in 1988. Underground diamond drilling totalling 5945 feet was done from existing underground workings. Results were used to guide the ramp construction and to locate the extent of a graphite zone. During 1988, 500 m of ramping was completed in 1988. The ramp was started at the 105 m level and is scheduled to be at the 195 m level by the end of the first quarter of 1989. In addition, 18 771 feet of surface diamond drilling were done on the Owl Creek Property (Falconbridge Limited, personal communication, 1988).

Giant Yellowknife Mines Limited, Timmins Operations

Although the final 1988 figures were not available at the time of writing, it is anticipated that the Timmins Division of Giant Yellowknife Mines Limited will have recovered 117 150 ounces gold from 1 857 800 tons of ore at an average grade of 0.071 ounce gold per ton, and with an average mill recovery rate of 85 percent, from seven mining operations and three milling operations. Included in the above total are 5000 ounces of gold recovered from the company's heap leach operation. This compares to 1987 production totals of 120 727 ounces of gold from 1 946 313 tons of ore at an average grade of 0.072 ounce gold per ton. It is anticipated that approximately 100 tons of copper and 100 000 ounces of silver will have also been produced by the end of 1988.

SCHUMACHER DIVISION

At the Schumacher Mine, in Tisdale Township, 1988 production is estimated to have been 105 000 tons of ore at an average grade of 0.073 ounce gold per ton with 6580 ounces recovered. This compares to 1987 production figures of 171 969 tons averaging 0.068 ounce gold per ton for a recovery of 10 042 ounces. Most of the ore came from the Number 6 Shaft area, with the remainder coming from the No. 11 Shaft.

A total of 3320 feet of drifting and crosscutting, and 4350 feet of lateral stope preparation work were completed. An ore pass in the No. 6 Shaft area was completed with 1611 feet of raising done. Raising for stope preparation totalled 427 feet. The mine did 21 615 feet of underground diamond drilling and 1201 feet of surface diamond drilling. This does not include diamond drilling done by Pamorex Minerals Incorporated on the mine property (*see* 'Pamorex Minerals Incorporated'). Towards the end of 1988, the only production was from the pulling of one stope in the No. 6 Shaft area. This operation was expected to be finished by year end and the Number 6 Shaft closed. The Schumacher Mine Property will then be considered as an underground exploration project. On the 1250–foot level, 1500 feet of crosscutting was done to the downward projection of the 20 and 24 Vein systems on the Coniaurum Property. These were previously mined above the 800–foot level. At the end of 1988, drifting had started on both veins.

NUMBER 1 MINE

The 1988 production at the Number 1 Mine in Whitney Township is expected to have reached 685 000 tons of ore at an average grade of 0.070 ounce gold per ton with 41 860 ounces of gold recovered. This compares to 1987 production of 701 873 tons at 0.073 ounce gold per ton for a bullion output of 44 722 ounces. A total of 15 000 feet of lateral development and 9000 feet of vertical development was completed in 1988. Underground diamond drilling totalled 29 000 feet. Twenty percent of the ore came from narrow high–grade veins (grading 0.16 to 0.30 ounce gold per ton) in the volcanic rocks to the north. The balance came from the lower–grade, large quartz stockworks in the greywackes and conglomerates to the south. The mineable reserves at the end of 1987 were 5 725 000 tons at a grade of 0.070 ounce gold per ton.

TIMMINS PROPERTY

The open pit at the Timmins Property (formerly the Hollinger Mine) is expected to have recovered 10 284 ounces of gold from 165 000 tons of ore mined in 1988 grading 0.075 ounce gold per ton. Production in the previous year totalled 178 144 tons grading 0.075 ounce gold per ton for a recovered output of 11 099 ounces. On the property, the Central Shaft was bulkheaded at 400 feet below surface and the headframe and hoistroom were removed. This was done in preparation to mine the ore remaining in the shaft pillar by open pit. This is the last known ore block on the property amenable to open pit mining. Open pit mining has been conducted on the property almost continually since 1976 with over 2 500 000 tons of ore having been removed. At the end of 1987, reserves accessible for mining were estimated to be 259 000 tons at a grade of 0.069 ounce gold per ton. Not included in this figure were 170 000 tons grading 0.08 ounce gold in the Central Shaft pillar.

DELNITE PROPERTY

A small open pit is located at the Delnite Mine Property in Deloro Township. In 1988, an estimated 9500 tons of ore grading 0.060 ounce gold per ton were mined, providing 468 recovered ounces of gold. The 1987 production recovered 3134 ounces of gold from 49 567 tons of ore averaging 0.077 ounce gold per ton. At the end of 1988, the company completed 2000 feet of surface diamond drilling on a gold zone outlined east of the Delnite Pit, in 1988. An underground decline ramp is planned to reach this material.

NUMBER 3 PIT

During 1988, the Number 3 Open Pit, adjacent to the Number 1 Mine, will provide 575 000 tons of ore grading 0.053 ounce gold per ton for a recovered production of 25 800 ounces of gold. This compares with the 1987 figure of 29 103 recovered ounces from 625 017 tons grading 0.055 ounce gold per ton.

Surface diamond drilling done in an attempt to expand ore reserves around the pit totalled 12 000 feet. At the end of 1987, ore reserves at Number 3 Pit were 3 504 000 tons at 0.60 ounce gold per ton. To the east of the Number 3 Pit, the Number 4 Pit produced 78 292 tons at an average grade of 0.072 ounce gold per ton resulting in 4775 ounces. The pit was mined only in 1988 and the ore was exhausted by late summer. Surface diamond drilling totalling 4000 feet was done on the west side of the Pamour Number 1 Property adjacent to the Broulan Mine Property. Belmoral Mines Limited had conducted an open pit operation to mine the stope crown pillars on the Broulan Property in 1987. Crown pillars on the Pamour side were evaluated and open–pit mineable reserves were outlined. A mining feasibility study is presently being done on this area.

HEAP LEACHING

Giant Yellowknife Mines Limited was one of the first organizations to use heap leaching technology in Canada. A successful test program was done at the Pamour Number 1 mine site in 1986, and a commercial pad was constructed in 1987. At the end of 1988, three heap leach pads existed with a total tonnage of 330 000 tons grading 0.029 ounce gold per ton being produced. All of the material which would have been previously considered as waste came from the Number 3 Pit. Over 400 000 tons were crushed in 1988. One hundred thousand tons were unloaded. A recovery of 5000 ounces has been estimated for 1988. At the end of 1987, reserves suitable for heap leaching at the Number 3 Pit were estimated to be 2 375 000 tons at 0.029 ounce gold per ton.

At the end of 1987, Giant Yellowknife Mines Limited employed 807 people at its operations in Timmins (Giant Yellowknife Mines Limited, Annual Report, 1987, personal communication, 1988).

GOMILL

The company custom–milled 43 850 tons of ore from the Total Energold Corporation–Davidson Tisdale Mines joint venture mining operation at the Davidson Mine in Tisdale Township. Approximately

10 000 tons of refinery brick were milled for Sabin Brick.

ROSS MINE

The Ross Mine produced 22 364 ounces of gold from 240 000 tons of ore grading 0.112 ounce gold per ton in 1988. The previous year's output was 219 779 tons grading 0.116 ounce gold per ton for a recovery of 21 047 ounces.

Placer Dome Incorporated, Detour Lake Mine

Placer Dome Incorporated is now the sole owner of the Detour Lake Mine, having acquired the 50 percent interest in the property formerly held by Amoco Canada Petroleum Company Limited. Ore reserves for the deposit are currently being revised and will be published in 1989. Reserve figures released in 1988 were given as 8 800 000 tons grading 0.145 ounce gold per ton.

During 1988, a total of 699 000 tons were mined and 800 100 tons were milled. The larger figure for tons milled included previously mined and stockpiled low-grade ore. Three mining methods were used during the year: mechanized cut-and-fill, blast hole mining, and captive cut-and-fill. Lateral development and ramping totalled 5288 m. The ramp has been completed from the 360 m to the 460 m level, with the ramp from the 260 m to 360 m level to be completed by early 1989. The section of the ramp from the 260 m level to the surface is scheduled to be completed by the end of 1989.

The shaft has been deepened to 598 m with the bottom level at 560 m. Stoping was done on the 260 m, 360 m, and 460 m levels. Raising totalled 362 m in 1988 and 20 000 m of underground diamond drilling were done.

At the end of 1988, 340 people were employed by the Detour Lake Mine (Placer Dome Incorporated, personal communication, 1988; Placer Dome Incorporated, Annual Report, 1987).

Placer Dome Incorporated, Dome Mine

The latest phase in the expansion and modernization of the Dome Mine ended in 1988 with the completion of a $15 000 000 program. This came directly after a $95 000 000 capital expenditure which saw a new mill built, as well as the sinking of the new Number 8 Shaft to 5200 feet below surface. This recent phase increased the mill capacity to 3300 tons per day and replaced the 58-year old gold recovery section of the mill with a carbon-in-pulp circuit.

In May of 1988, damage caused by a skip falling down the new Number 8 Shaft halted all production from this shaft until early 1989. Fortunately, the company had started an open pit in 1987 to stockpile ore for a scheduled shut-down of the shaft in order to replace the wooden shaft guides with steel guides. This increase in open pit production compensated for the shortfall of ore from Number 8 Shaft. In October, problems with the Number 3 Shaft hoist shut this shaft down, and, for two weeks, no ore came from underground. The mill still operated at 3000 tons (from its 3300 ton per day capacity) with an increase in production from the pit. In November, the company started a second pit.

Although the 1988 figures were unavailable at the time of writing, it is expected that the Dome Mine will have milled 1 160 000 tons of gold ore by the end of the year. Because this includes 300 000 tons of lower-grade open pit ore, the grade, and therefore the number of ounces produced, will be lower than that in 1987. In that year, 132 017 ounces of gold were recovered from 1 100 000 tons of ore grading 0.126 ounce gold per ton.

Underground ore sources, by mining method, are 30 percent from longhole stopes; 20 percent from sloughing or overpull in old shrinkage and longhole stopes; 23 percent from mechanized cut-and-fill panel stopes; 12 percent from captive cavo loader, cut-and-fill stopes; 6 percent from narrow vein cut-and-fill stopes; and 9 percent from development on ore. The mine still had a shortage of experienced miners in 1988, which restricted production from narrow cut-and-fill stopes.

Ore reserves at the end of 1987 were calculated to be 5 900 000 tons grading 0.150 ounce gold per ton. This is approximately a 100 percent increase from that reported a year earlier due to the fact that the Dome Mine changed its conservative policy of reporting only proven reserves which could be mined without further development costs. The new figure includes both proven and probable mineable reserves.

In 1988, 14 300 feet of lateral development (drifts, crosscuts, and subdrifts) and 1450 feet of raising were done. This figure was lower than the 1987 totals of 14 944 feet and 1740 feet, respectively. In 1988, underground diamond drilling totalled 62 000 feet. This is lower than the 1987 figure of 64 085 feet. Surface drilling for 1988 amounted to 4150 feet. This was done to outline ore in the open pit areas.

Most underground mining was done above 4000 feet (26 Level). The deepest stope being prepared is on the 32 Level (4800 feet below surface). The top mining level is the 7 Level (1000 feet below surface). Potential for more ore still exists above the 1000-foot level. Since open pit mining was very successful, the company will be looking for more open pit mineable material and shallow underground ore which would be accessible by a ramp from surface.

The mill capacity will be up to 3800 tons per day in 1989 but planned underground production is 3300 tons per day. Open pit material could bring the mill to planned operating capacity.

In 1987, a quarry near Number 8 Shaft was started to supply rock fill to old shrinkage stopes and quarrying has been suspended. Raises were driven to surface and this rock was dumped directly into the stopes. Since then, over 300 000 tons of waste rock has been produced by open pit mining.

A total of 712 people were employed at the Dome Mine in 1988 compared to 753 in 1987 (Placer Dome Incorporated, personal communication, 1988).

Total Energold Corporation—Davidson Tisdale Mines Limited, Davidson Mine

After three underground exploration programs since 1985 and extensive surface diamond drilling on the Davidson Mine Property, a production decision was made in December 1987, by the joint venture partners Total Energold Corporation and Davidson Tisdale Mines Limited. At that time mineable reserves were published at 53 000 tons grading 0.23 ounce gold per ton. This had been drastically cut from the figure of 823 850 tons grading 0.36 ounce gold per ton published in 1986. Because of the erratic nature of the gold mineralization within the quartz–vein structures, establishing grade continuity was impossible. Mining was done under contract at a rate of 260 tons per day and ran from mid–January to June. Ore was initially stockpiled and then hauled for custom milling at the GOMILL at the Schumacher Mine site of Giant Yellowknife Mines Limited. Milling finished on November 10th with a total of 43 850 tons having been processed. Included in this was 10 000 tons of development ore which came from the previous underground programs.

Recovery problems were encountered with the jig concentrate and 75 tons of this concentrate were shipped to Sabin Metals in Rochester, New York. All the float concentrate was treated in Schumacher.

A total of ten small stopes were mined between the 100–foot and 500–foot levels with most of the tonnage being taken off the 400–foot level. Underground access was via a decline ramp from surface which was previously driven for underground exploration and evaluation.

It was found that quartz veining was discontinuous and irregular, and could be described as blow–outs on both the hanging wall and footwall sides of subsidiary faults off the Main Mine Fault. These quartz zones had a westerly plunge with a steep dip which flattened out at the bottom. The biggest vein had a strike length of 30 m but only extended 15 m downdip. The gold mineralization was on both the hanging wall and footwall contacts of the veins, but concentrations were erratically distributed. It was announced in August 1988, that the joint venture partners made an agreement with Midas Minerals Incorporated by which this company could earn a 60 percent interest in the property for a $2 000 000 expenditure. The focus of the work will be on surface drilling to explore beneath the 500–foot level. Drilling is to start in early 1989 (Total Energold Corporation, personal communication, 1988; various articles, Northern Miner, 1988).

INDUSTRIAL MINERALS

Roseval Silica Incorporated

Total production from Roseval Silica's quarry operations in southwestern Penhorwood Township was 42 397 t of high–purity silica. All 1988 production was from the Site 2 Vein zone, where *in situ* reserves are currently estimated at 200 000 t grading better than 90 percent silica. The quarry is operated on a seasonal basis.

During 1988, 11 017 t of high–purity silica were shipped to SKW Canada Incorporated in Becanour, Quebec. An additional 347 t was shipped to SKW Alloys in Niagara Falls, New York. K. Smith of Orillia purchased 355 t of crushed quartz for incorporation into precast concrete.

Falconbridge Incorporated received 2323 t of crushed silica from Roseval in 1988. The silica was purchased in two size fractions for fluxing test purposes at Falconbridge Incorporated's metallurgical site in Timmins (Roseval Silica Incorporated, personal communication, 1988).

Steetley Talc Limited

In 1988, Steetley Talc Limited mined 126 000 tons of ore by open pit methods. In total, 135 000 tons of ore were milled, including stockpiled ore from previous mining. The ore was mined and the talc concentrated at the mine site in Penhorwood Township. The concentrate was trucked to the company's fine grind plant in Timmins. At present, the plant is running at 450 tons per day from which 150 tons of beneficiated talc are produced.

In 1987, the company completed a $4 200 000 expansion bringing the total talc producing capabilities to 60 000 tons per year.

Steetley Talc employs 50 people at its operations as it has done since 1985 (Steetley Talc Limited, personal communication, 1988).

ADVANCED EXPLORATION AND DEVELOPMENT

Associated Porcupine Mines Limited—American Reserve Mining Corporation

In December 1987, it was announced that a $15 200 000 exploration and development program on the old Paymaster Mine Property in Tisdale Township will be funded by American Reserve Mining Corporation under a joint venture agreement with Associated Porcupine Mines Limited. With the use of flow through exploration funds, American Reserve could earn a 50 percent interest in the property. More than $3 000 000 was spent on a deep-hole, surface diamond drilling program in 1988.

The object of the deep drilling program was to explore for the downward extension of ore-grade mineralization between 6025 and 7000 feet below surface. Eight cuts through the zone were completed along four sections, with the sections being 300 feet apart. The upper intersection was 150 feet below the 6025-foot level (the lowest level in the mine), and the lower intersection was 675 feet below the level.

Two drills were located on surface, 300 feet apart, each drilling a 7000-foot hole. When each drillhole was through the zone, three more holes were wedged off each of the original holes. The first drill started January 30th and the second on February 15, 1988. HQ size-core was drilled initially in the upper part of each hole, with NQ core recovered for the rest. The direction of the holes was controlled by a Navi-Drill.

Later in 1988, a new headframe was erected over Number 5 Shaft, and, by the end of 1988, the shaft was rehabilitated to 250 feet below surface. Plans have been made to sink the Number 6 Winze to the 6475-foot level and establish 3 levels, 150 feet apart. Underground drilling in this area totalling 10 000 feet has been proposed.

The mineral inventory published for the mine property is 794 000 tons grading 0.223 ounce gold per ton. No increase in inferred reserves has been announced as a result of the recent drilling (Associated Porcupine Mines Limited, personal communication, 1988; various Northern Miner articles, 1988).

In December 1988, it was announced that American Reserve Mining Corporation and Associated Porcupine Mines Limited had agreed on a merger proposal by which American Reserve would take over a 100 percent interest in Associated Porcupine for $12 000 000.

BHP-Utah Mines Limited

One 1700-foot surface diamond-drill hole was drilled by BHP-Utah Mines Limited to explore for the downplunge extension the company's nickel deposit in Eldorado Township. Unfortunately, the hole entered a diabase dike and was stopped before the projected mineralization was reached.

The nickel deposit was discovered in the late 1970s and has a drill-indicated reserve of 750 000 tons grading 2.28 percent nickel to 800 feet below surface.

At the time of writing, BHP-Utah Mines Limited was evaluating offers from other interests for a partnership in the deposit (BHP-Utah Mines Limited, personnal communication, 1988).

Belmoral Mines Limited—Broulan Resources Inc.—Wrightbar Mines Limited

Shaft rehabilitation was completed to the 2500-foot level (the bottom level of the mine) at the Broulan Reef Mine in Whitney Township. The shaft was deepened by 44 feet in order to set up a system to hoist waste rock from the 2500-foot level. The original plan to deepen the shaft to 3500 feet below surface, and drift 5000 feet eastward to the Hallnor boundary may not be followed. Instead, drilling at the eastern end may be done from the existing 2500-foot level; but first the level has to be rehabilitated and 600 feet of lateral development will have to be done. Drillholes will be considerably longer and "Navi" directional drilling will be used. Although the 1988 figures were incomplete as of December 11, 1988, a total of 50 feet of lateral development was done on the 2500-foot level. For 1989, 25 000 feet of underground drilling is planned for 1989 from the 2500-foot level.

On the 500-foot level, a total of 2050 feet of lateral development was done to access the "C" Zone for underground exploration and evaluation. A total of 11 200 feet of underground diamond drilling was done with another 15 000 feet scheduled for 1989.

Surface diamond drilling totalled 7600 feet in 1988 as part of a 20 000- to 40 000-foot program (depending on results) which started late in the year. This was done at the western end of the mine property to define previously indicated mineralization, and to explore for new zones between 400 and 1700 feet below surface.

Belmoral Mines Limited—Vedron Limited Joint Venture

Since the underground project in Tisdale Township began in mid-1986, over $10 000 000 has been spent on the property. Most of the work has been done on the Fuller Zone. This zone consists of three shoots with a published mineral inventory of 340 000 tons grading 0.164 ounce gold per ton. Some additional development and drilling was done on the 37 Zone, southwest of the Fuller Zone. The ramp reached the 650-foot level in 1988. Although the figures were not available, it is estimated that a total of 5640 feet of underground development was done on the property in 1988. This included ramping, raising, lateral development on seven levels and sublevels, drill bays, and remuck bays. Underground drilling totalled 47 800 feet. Surface diamond drilling totalled 21 561 feet (Belmoral Mines Limited, personal communication, 1988).

In both projects, the Vedron and the Broulan, Belmoral Mines Limited employs 68 people (Belmoral Mines Limited, personal communication, 1988; various articles, Northern Miner, 1988).

Breakwater Resources Limited (Novamin Incorporated)

The multi-phase surface and underground exploration program on the Rundle No. 1 (South) gold deposit in southeastern Newton Township began in late June 1987, and was completed in late December 1987. The program included decline ramp development, shaft rehabilitation and sinking, minor lateral development, and surface and underground diamond drilling. During the period of January to June 1988, evaluation and compilation of the data was undertaken.

Three main gold-mineralized ore shoots were initially interpreted to strike 110°, conforming to a zone of deformation and alteration which marks the contact between a feldspar porphyry intrusive body and mafic to ultramafic metavolcanics. However, underground mapping indicated a 135° to 140° trend to the ore zones. All data gathered to date was re-interpreted. Strike lengths vary between 30 and 80 m while downdip continuity extends for hundreds of metres. Ore-zone geometry varies with depth. Near surface, the Shaft Zone consists of stockworks with widths up to 15 m over short strike lengths. With increasing depth they coalesce into two main zones. Below the 200 m level, only one narrow zone was intersected by drilling, but the strike length increased substantially. The Shaft Zone is open below 400 m and to the southeast at depth.

The East Zone exhibits similar geometry. Above 200 m, it consists of a single, short strike-length shoot. Below 200 m, the zone branches into two or more shoots with longer strike lengths. The East Zone is open below 400 m and to the southeast at depth.

The A-South Zone is different from the other known zones that make up the Rundle Deposit. It occurs within a conformable 110° trending shear zone in the hanging wall ultramafic flows. This zone does not come to surface. Gold values are associated with quartz veining at the western end of a sheared and altered feldspar-porphyry sill that has intruded a thin, cherty, pyritic interflow sediment. The mineralized zone has a shallow, westerly plunge as opposed to the West, Shaft and East zones, which plunge steeply southeast. The A-South Zone is open at depth. The West Zone, No. 2 Vein Zone, and the Southeast Vein Cluster Zone, were not evaluated during the recent program.

A preliminary mineral inventory was updated based upon muck sampling, face and back chip sampling, and diamond-drill core assays. A cutoff of 3.4 g/t gold and a minimum mining width of 1.5 m were used. Total reserves in all categories above the 195 m level were estimated to be 266 410 t with an average grade of 7.35 g/t gold. Total drill-indicated and drill-inferred reserves below the 195 m level to a maximum depth tested of 470 m were estimated to be 268 410 t with an average grade of 5.72 g/t gold. Most of the reserves are hosted by the Shaft Zone above 200 m, and the East Zone below 200 m.

Initial check-assay data suggest there might be a slight increase in reported tonnages and grades.

On Breakwater's North Rundle Property in northwestern Newton Township, a detailed geological mapping program was completed during 1988 (Breakwater Resources Limited, personal communication, 1988).

Canamax Resources Incorporated—Bruneau Mining Corporation, Clavos Property

Canamax Resources Incorporated and Bruneau Mining Corporation intend to proceed with underground exploration at their Clavos gold deposit in German and Stock townships where drill-indicated reserves of 643 500 tons averaging 0.22 ounce gold per ton or 1 160 000 tons averaging 0.15 ounce gold per ton in five distinct zones have been outlined. Plans by the joint venture partners include sinking a vertical 320 m deep exploration shaft and establishing two levels on which lateral exploration and underground diamond drilling can take place (Canamax Resources Incorporated, personal communication, 1988).

Chesbar Resources Incorporated—Murgold Resources Incorporated

Chesbar Resources has a 60 percent interest in, and is managing the exploration program on, a 70-claim gold property in northeastern Chester Township. Murgold Resources retains a 40 percent interest in the property. An extensive surface and underground exploration program, initiated in 1986, continued through 1988.

Early in 1988, a 3.0 m by 4.8 m access ramp was driven from the 280-foot level of the main ramp into the hanging wall of the No. 3 Vein system. The ramp was driven 2025 feet at a minus 12.5 percent grade to the 515-foot level. A second 3.0 m by 4.8 m access ramp was turned off the main ramp at the 200-foot level. This ramp was driven 487 feet at a minus 15 percent grade to the 275-foot level.

Lateral development, started in 1987 on the 150-foot level, continued while new declines were being advanced. On the No. 3 Vein, total drift development was 265 feet and total raising of 31 feet from the west end of the drift. A total of 165 feet of drifting was completed on the 3A Vein. Development on the 3B Vein totalled 274 feet of drifting and 51 feet of raising from the east end of the drift. The 3B Vein represents the "hanging wall" and the No. 3 Vein represents the "footwall" of the No. 3 Vein system. The 3A Vein is equidistant between the No. 3 and 3B veins. Although the structures controlling emplacement of the No. 3, 3A, and 3B veins are relatively continuous, vein development is not. Diamond-drill data suggests the central 3A Vein is the most continuous of the several veins encountered to date within the No. 3 Vein System.

Lateral development at the 400-foot level from the hanging wall access ramp included 175 feet of crosscutting and 686 feet of drifting on the 3A Vein. A small crosscut was driven from the west drift 75 feet into the footwall to investigate an isolated drill intersection. One raise round was taken. From the east end of the 400-foot level drift, a raise was driven 185 feet on the 3A Vein to a recently developed drift on the 275-foot level.

Limited work at the 500-foot level totalled 160 feet of crosscut and drift development.

Extensive lateral development was done on the 3A Vein at the 275-foot level. A stope-development drift had been driven 902 feet on-vein, and a 3 m by 3 m haulage drift had been driven for approximately 400 feet parallel to the smaller development drift.

Two raises from the 275-foot level totalling 276 feet were scheduled for completion prior to the Christmas shutdown. Approximately 80 feet of raising had been completed as of December 2, 1988.

Underground diamond drilling in 1988 totalled 30 666 feet in 95 holes. Drilling tested the No. 3 Vein System to a vertical depth of 700 feet. The deposit remains open at depth.

Total reserves in the No. 3 Vein System currently stand at 482 226 tons with an average grade of 0.25 ounce gold per ton, including 71 078 tons with an average grade of 0.40 ounce gold per ton in the "probable" category.

Results of the final holes from the 1987 surface diamond drilling program indicate the No. 8 Vein System is the northwestern extension of the No. 3 Vein System. This implies a drill-defined strike length of 5300 feet with potential for extension in both directions. West of the developed portion of the No. 3 Vein System, a 500-foot wide diabase dike swarm disrupts the continuity of the mineralized structure.

During 1988, 42 surface drillholes totalling 11 196 feet were completed on the property. Two holes totalling 722 feet were drilled to test the recently discovered Vero Zone, located in the southwestern corner of the property, 2500 feet southwest of the No. 3 Vein System. Chesbar reported that good values over narrow widths were intersected, and further evaluation will be carried out in the future.

The balance of the 1988 surface drilling was carried out on the No. 1 Vein System, located 1300 feet northeast of the No. 3 Vein System. Previous drilling on the structure, which trends parallel to the No. 3 Vein System, defined the zone above the 300-foot vertical level over a 2100-foot strike length. The No. 1 Vein System remained open in all directions. The 1988 drilling program tested a 1350-foot long section of the No. 1 Vein System where good grades and widths were encountered previously. Drill results were encouraging and the joint venture partners believe the No. 1 Vein System has ore-reserve potential.

Late in 1988, tenders were issued for construction of an expandable 150 ton per day, gravity and flotation test mill to be built on the Chester Township Property. Plans call for turning the facility into a production mill, capable of an initial output of 10 000 to 15 000 ounces of gold per year. Initial mill feed will come from development ore. By October 1988, approximately 7400 tons of development ore with an estimated average grade of 0.15 ounce gold per ton had been stockpiled on surface.

Detailed surface exploration on the outlying claims included 50 line-miles of ground geophysical surveys, 60 line-miles of prospecting, and 12 line-miles of detailed geological mapping.

Estimated total expenditures for 1988 totalled $4 200 000. Plans for 1989 include continued development of the No. 3 Vein System from the two working levels at 275 feet and 400 feet. A production decision could be made early in 1989 (Chesbar Resources Incorporated, Murgold Resources Incorporated, personal communications, 1987–1988; Murgold Resources Incorporated Press Releases, 1987–1988; Northern Miner Press, various articles, 1988; George Cross News Letter, various articles, 1988; The Financial Post, February 15, 1988; April 4, 1988; The Daily Press, various articles, 1988; personal observation, 1988).

Chevron Canada Resources Limited—Holmer Gold Mines Limited

Chevron Canada Resources Limited has an agreement with Holmer Gold Mines Limited to earn a 50 percent interest in the latter company's gold property in Bristol Township. Chevron completed 20 surface diamond-drill holes totalling 5299 m in 1988. Half of the holes were drilled on the main gold zone on which work done by previous operators outlined a mineral inventory of 720 000 tons grading 0.12 ounce gold per ton. The other half of the holes were drilled to test additional targets on the property. A surface stripping program was done on the main gold zone in 1988. An area 130 m by 90 m was exposed. In 1989 more surface diamond drilling and a recalculation of the reserves is being planned (Chevron Canada Resources Limited, personal communication, 1988; Northern Miner, February 29, 1988).

Delbridge Mines Limited

In 1988, Delbridge Mines Limited carried out a 300-foot stripping program on a gold zone 2000 feet southwest of the main shaft on the Desantis Mine property in Turnbull Township. Drilling, blasting, and sampling were also done. The company reported that surface samples have assayed up to 0.28 ounce gold per ton across 9.7 feet (Delbridge

Mines Limited, personal communication, 1988; Northern Miner, September 12, 1988).

Diepdaume Mines Limited

There was no development activity at the Diepdaume Mine (former Preston East Dome Mine) during 1988. The workings are being kept pumped out to 750 feet below surface. A 600 ton per day mill was completed on-site and custom gold milling was done for Falconbridge Limited (7600 tons of Owl Creek ore), Monte Carlo Gold Mines Limited (1500 tons from Chester Township), the Northfield Minerals Incorporated–Orcana Resources Limited–Morgain Minerals Incorporated joint venture (3026 tons from the Puissance Property in Deloro Township), and Duncan Gold Resources (3000 tons from Tyrrell Township) (Diepdaume Mines Limited, personal communication, 1988).

Jerome Gold Mines Corporation—Muscocho Explorations Limited

In an amended agreement with E.B. Eddy Forest Products Limited, Jerome Gold Mines has an option to purchase the Jerome Property in Osway Township from E.B. Eddy before April 30, 1989. Jerome Gold Mines will have paid $100 000 to E.B. Eddy on December 1, 1988 and will continue to make monthly payments of $25 000 until the option is exercised on or before April 30, 1989. The sum of the monthly payments is deductible from the purchase price of $2 500 000 less the monthly option payments made to date.

Muscocho Explorations Limited has earned 50 percent of Jerome's interest in the E.B. Eddy agreement and is operator of the exploration project. McNellan Resources Incorporated is participating in Muscocho's 50 percent interest in the property.

Late in 1987, Jerome Gold Mines announced the start of a major surface and underground exploration program on the Jerome Mines Property in east-central Osway Township. Discovered in 1938, the Jerome Deposit was developed and mined until put on standby basis in 1943 due to labour shortages. Limited development continued until 1945. Total production was 56 878 ounces of gold and 15 104 ounces of silver from 303 906.9 tons of ore milled. The mine was developed on six levels to 335 m below surface via a 347 m vertical shaft. Prior to commencement of the current program, reserves above 200 m, in the developed section of the Main Zone, stood at 282 134.5 t with an average grade of 6.9 g/t gold.

Dewatering of the shaft to below the third level at 152.4 m began late in 1987. The warehouse-garage was refurbished, headframe, hoist house, and shaft rehabilitation was begun, and an office-dry building was erected. By late January 1988, the first level at 61 m had been accessed. Dewatering continued until May, when a blockage in the shaft was encountered 125 m below collar. Evaluation of the second level, at 106.7 m, and clearing of the shaft was delayed until mid-August. With the obstruction removed, dewatering and shaft rehabilitation proceeded to the third level, at 152.4 m. Water levels are being maintained at 167.6 m.

From the shaft, on the 152.4 m level, the east drift has been slashed out 2.5 m wide by 2.75 m high for a distance of 298.7 m. At 305 m east of the shaft, a crosscut will be driven southward 130 m to access the South Zone. Approximately 460 m of drifting is planned on the South Zone. Two 1.25-yard load-haul-dump machines and a 5-ton truck are currently in use on the 152.4 m level.

As access to the 61 m and 106.7 m levels was gained, exploration, mapping, and surveying, where practical, was carried out. On the 106.7 m level, extensive open stopes and poor ground conditions made the level inaccessible. The east drift on the 61 m level was found to be in good condition. The drift was cleaned out, washed, and mapped in detail. Emphasis was placed on interpreting the complex nature of the main ore zones.

Early in 1988, a detailed surface diamond drilling program was started on the mine property. Phase I drilling, carried out between late 1987 and July 1988, included 65 holes, plus 3 extension holes totalling 14 020.5 m. This program tested the South Zone, located 125 m south of the Main Zone, to a vertical depth of 160 m over a 305 m strike-length. Several holes were extended northward and intersected the Main Zone below the 160 m level with favourable results. Preliminary drill-indicated reserves in the South Zone have been calculated at 114 595.6 t at an average grade of 6.0 g/t gold. The South Zone is open to the west and below the 160 m level.

Phase II drilling totalled 1767.8 m in four deep holes. Drilling was carried out to test the downdip and downplunge continuity of the Main Zone. This program is expected to continue from underground drill stations on the 152 m level South Zone drift.

Late in 1988, a 6100 m, Phase III, surface drilling program was in progress on the Main Zone. The program was designed to confirm existing reserves, define and upgrade areas of "possible" reserves, and to aid in the interpretation of structure. By early December, 14 holes totalling 2725 m had been completed. Drilling is expected to continue through to the end of February 1989.

Approximately 150 m east of the shaft, drilling intersected a well-developed mineralized zone, approximately 25 m north of existing development drifts, between the fourth level at 198.1 m and the fifth level at 243.8 m. On-site staff have suggested the new zone is actually the Main Zone at depth and that development drifting on the fourth and fifth levels may have followed a splay off the Main Zone. If this is the case, the Main Zone is dipping more steeply at depth. A recently initiated underground diamond drilling program from the 152.4 m level is continuing to define the zone (Muscocho Exploration Limited, personal communication, 1988; Jerome Gold Mines Corporation, Press Releases, 1988; Jerome Gold Mines Corporation, Semi-Annual Report to Shareholders, June 30, 1988; The Northern Miner Press, various articles, 1988; Financial Post, June 20, 1988, July 13, 1988; The Daily Press, March 26, 1988; personal observation, 1988).

Marshall Minerals Corporation

In early 1987, Marshall Minerals Corporation acquired the interest of Gail Resources Limited in their Carshaw and Malga properties in Shaw Township. In early 1988, Marshall Minerals made an agreement with St. Genevieve Resources by which the latter company can earn a 30 percent interest in these properties by spending $3 000 000. A 500 ton per day mill built in 1984 stands on the Carshaw Property. Some open pit mining was done on the property in 1983 and 1984. Various exploration programs consisting mostly of diamond drilling have been conducted since 1980. Published reserves are 200 000 tons grading 0.205 ounce gold per ton.

The Carshaw underground workings were pumped out in early 1988, and a minor amount of sampling and mapping was done. In March, a six-hole (4884 feet total) surface diamond drilling program was conducted to the east of the Carshaw gold-bearing iron formation to explore for a possible eastern extension facies change (a gold-bearing cherty conglomerate horizon).

In the fall of 1988, 39 (10 271 feet total) surface diamond-drill holes were drilled into the Carshaw Zone. This program ended on November 14th. Two drilling programs, both totalling 10 000 feet, have been planned for early 1989.

The underground workings were pumped out again in late 1988 for re-mapping and some check sampling. Minor repairs were done to the mill building and the crusher house, which was on top of some mineralization, was moved (G. Wahl, P. Dunbar, Consultants, personal communication, 1988; Northern Miner, February 15, 1988).

New Texmont Explorations Limited

New Texmont Explorations is constructing an eight-mile road to two gold zones in Tully Township (Intex and Frankfield deposits). By the end of 1988, 2.5 miles were completed with another 1.5 miles slashed. As of December 1988, a 5000-foot surface diamond drilling program had been started on the Intex Zone, and the downdip and westerly extension of the zone which occurs on the property of Gowest Amalgamated Resources Limited. New Texmont and Gowest have a joint venture agreement for exploration and development of the zone on Gowest's ground.

Intex Mining Corporation Limited has a 63.6 percent interest in the two deposits and Frankfield Explorations Limited has the remaining 36.4 percent. New Texmont Explorations Limited owns the controlling interest of Intex Mining. The combined mineral inventory on the two deposits is 300 000 to 400 000 tons grading 0.25 ounce gold per ton (New Texmont Explorations Limited, personal communication, 1988; Northern Miner, July 25, 1988).

Noranda Exploration Company, Limited—Golden Princess Mining Corporation

Golden Princess Mining Corporation has been funding a surface evaluation of the Nickel Offsets gold deposit in Tully Township to earn half of Noranda Exploration's 50 percent equity. Noranda Exploration, the operator, has an agreement with Canhorn Mining Corporation to obtain 70 percent interest in the property. Surface diamond drilling has been ongoing since mid-1987 with 19 holes totalling 4000 m drilled in 1988. Of these holes, 15 were drilled on the deposit and 4 were drilled to explore other targets on the property. No updated reserves have been published since the work began. Results from 51 holes, drilled by previous operators, have indicated reserves of 600 000 tons of ore grading 0.23 ounce gold per ton. Additional drilling is planned in 1989 to test the vertical extension of the deposit to a depth of 1200 feet (George Cross News Letter, Northern Miner, various articles, 1988; Noranda Exploration Company, Limited, personal communication, 1988; Golden Princess Mining Corporation, Annual Report, 1988).

Noranda Exploration Company, Limited—Tarzan Gold Incorporated

In September 1988, Noranda Exploration and Tarzan Gold entered into an agreement which gave Tarzan Gold the right to earn a 50 percent interest in the former's Joburke Property in north-central Keith Township by spending $2 000 000 over three years. The Joburke Deposit was discovered in 1946, and development continued until 1948. A vertical shaft was sunk to 425 feet and drifting was done on the 250- and 375-foot levels by Joburke Gold Mines Limited. The deposit produced continuously between 1973 and 1975, and again between 1979 and 1981. Tarzan Gold recently reported that a total of 440 117 tons of ore with an average grade of 0.1 ounce gold per ton was produced. Most of the ore was mined from the Main East Zone above the 375-foot level and the Main West Zone above the 500-foot level. Several additional gold zones are know on the 20 patented claim property.

Late in 1988, a 40 line-kilometre metric grid was cut on the property and ground magnetometer and induced polarization (IP) surveys were carried out. Soil geochemical surveys were completed over selected areas, and geological mapping was initiated prior to freeze-up. Extensive north-south trenches were dug across the property to aid in geological interpretation and to test shallow geophysical and geochemical anomalies.

A planned, 20–hole, 4000 m diamond drilling program was scheduled for completion in 1988. As of December 15, 1988, the 17th hole was in progress. Five deep holes were drilled under the existing mine workings on the East Main and West Main zones to test for a downplunge extension at a vertical depth of 200 m. Three holes were collared to test geophysical targets and surface showings on other parts of the property. Two holes were drilled between the 6 and 7 Vein systems and the North Vein zones. The remaining holes in the program were collared to test the continuity of the 6 and 7 Vein systems which are exposed in a small pit approximately 250 m west of the existing shaft (Noranda Incorporated, personal communication, 1988).

Northfield Minerals Incorporated—Orcana Resources Limited—Morgain Minerals Incorporated

A 15 000–foot surface diamond drilling program was conducted on the former Puissance Property in Deloro Township in early 1988. The best gold values were obtained on the western side of the carbonate zone. In late 1988, 3026 tons of material, blasted from surface in late 1986, was hauled to, and milled at, the Diepdaume Mines Limited mill on the Preston East Dome Property in Tisdale Township (K. Lapierre, Consultant, personal communication, 1988; Diepdaume Mines Limited, personal communication, 1988; Northern Miner, March 21, 1988).

Orofino Resources Limited

Orofino Resources completed a $3 200 000 combined surface and underground exploration and development program on their wholly–owned Swayze Gold Deposit (formerly the Orofino Mine) located in southeastern Silk Township. The underground program began in October 1987, and was completed in June 1988. The purpose of the program was to block out and prove a previous ore reserve estimate of 219 538 tonnes averaging 8.2 g/t gold, above the 122 m level.

The main ramp, measuring 4.27 m by 4.57 m, was driven 522.4 m at minus 18 percent grade to a final depth of 103.6 m below the old shaft collar. A 4.27 m by 4.57 m access ramp was driven 159.7 m at minus 18 percent grade from the 48.8 m level on the main ramp to the 77.5 m level. The main ramp connected with the existing mine levels at 45.8 m and 83.8 m. Crosscutting and sump development totalled 531.26 m. Sublevel drifts were established from crosscuts on the 35 m, 65.5 m, and 99 m levels. Total drift development on the sublevels was 476.7 m. Approximately 335.3 m of drifting was done on mineralization as well as three test raises totalling 241.1 m. The R–21 raise was driven in two stages at plus 28° to follow the gently dipping No. 1 North Vein. The R–24 and R–17 raises were both driven at plus 47° to follow the steeper No. 1 South Vein.

A total of 2602 m^3 of waste and 1253 m^3 of ore were slashed out during development. Total development ore stockpiled on surface was 16 722 t of unspecified grade.

Twelve surface diamond–drill holes, totalling 426.7 m, were completed to test the vein zones above the old first level workings at 45.7 m. Detailed underground diamond drilling totalled 3682.9 m in 145 holes. Geological mapping and sampling was completed during the final phases of the underground exploration program.

Since Hollinger Consolidated Gold Mines Limited first drilled the deposit in 1936, 495 surface and underground diamond–drill holes totalling 50 160 m are known to have been drilled on the deposit. An updated mineral inventory is expected early in 1989 (George Cross News Letter, April 11, 1988; Northern Miner Press, April 18, 1988; Orofino Resources Limited, personal communications, 1987 & 1988).

Pamorex Minerals Incorporated

Pamorex Minerals Incorporated and Giant Yellowknife Mines Limited entered into an agreement whereby Pamorex would perform all mine site exploration under contract to Giant Yellowknife on the latter's properties which are contiguous with their producing mines. In Timmins, a mine site exploration department was set up by Pamorex to conduct exploration projects on the Timmins properties of Giant Yellowknife. Up until June 1988, work consisted of compilation and project generation. Extensive diamond drilling then began on the Coniaurum Property.

In Tisdale Township a four–hole, 7500–foot, surface diamond drilling program was done to test the downward extension of the Coniaurum 20 and 24 Vein systems below the 1250–foot level.

Also in Tisdale Township, between the Bishop Shaft and Jupiter Shaft on the Coniaurum and McIntyre grounds, respectively, mapping, stripping, trenching, and geophysical surveys were done, followed by a 7280–foot, surface diamond drilling program.

In the Schumacher Mine (McIntyre), the upper extension of the 10 Vein within the Pearl Lake Porphyry was explored by an 8000–foot, underground diamond drilling program from the 1125–foot level.

In Deloro Township, on the Aunor and Delnite properties (Pamour No. 3), a 5000–foot underground diamond drilling program was conducted from the Aunor workings to test a narrow, gold–bearing, quartz–vein structure in the basaltic rocks south of the talc–chlorite zone. Also in the Aunor–Delnite area, 12 500 feet of surface diamond drilling was done to explore for near–surface ore. A gold zone east of the Delnite pit was outlined and will be evaluated further by the Giant Yellowknife geology, engineering, and production staff.

At the Pamour No. 1 Property in Whitney Township, 17 000 feet of surface diamond drilling was done in the volcanic rocks to the north of the mine. All drilling was to explore to 800 feet below surface in previously largely unexplored ground. A large program will continue here in 1989 (Pamorex Minerals Incorporated, 1987; Annual Report March 31, 1988).

St. Andrew Goldfields Limited

Mill construction has started on the Stock Township mine site of St. Andrew Goldfields. At the end of 1988, the foundations had been completed and the steel frame erected. Mill components have been arriving on the property. Estimated cost of the 500 ton per day capacity mill is $16 000 000. Mill capacity can be increased to 1000 tons per day to accommodate possible future production from other zones, including those in Taylor Township.

Since incorporation of the company in 1983, $20 000 000 has been spent on the Stock and Taylor Township properties, most of it for underground development and exploration.

In 1988, St. Andrew Goldfields purchased, for $950 000, the interest of Esso Minerals Canada Limited in the 12 claims adjoining the Stock Township Mine. The company now has a 100 percent interest in these claims.

In 1988, the company raised $21 000 000 in European financing to enable the Stock Township mine to be brought into production.

During 1988, 899 feet of drifting, 272 feet of raising, and 12 351 feet of surface diamond drilling were done in the mine area. A total of 5725 feet of surface diamond drilling was done to explore a gold zone 2000 feet east of the shaft, and 8589 feet of drilling was done to explore another zone 2000 feet west of the shaft. Another drilling program is to begin in early 1989 on the eastern zone. No underground diamond drilling was done in 1988. The underground development which took place was preparatory work to bring the mine into production. Access drifts, access raises, and vent raises were driven. Stope preparation work will begin in the new year. Two mechanized cut-and-fill stopes are planned in the N-2 Zone; one on the third level and one on the fourth level. A shrinkage stope is planned for the M-2 Zone; after the stope is mined out, it will be used to accommodate waste rock. Total reserves at the Stock Township Mine are estimated to be 1 300 000 tons of ore averaging 0.186 ounce gold per ton (St. Andrew Goldfields Limited, personal communication, 1988; various Northern Miner Press articles, 1988).

Stan West Mining Corporation—Cancord Resources Incorporated—Noranda Exploration Company Limited, DeSantis Mine Project

The joint venture partners have placed the evaluation of the former DeSantis Mine in Ogden Township on standby following completion of Phase II of the project. Mine workings have been allowed to flood, and the hoist and headframe will remain on site at minimal cost. The stated object of the program was to develop 500 000 to 600 000 tons of albitite ore between the 1175-foot level, the bottom of the Number 2 shaft, and the 2000-foot level. Current reserves for the mine are now calculated at 228 668 tons grading 0.193 ounce gold per ton. Work done from December 1987 to the February 28, 1988, completion date included 10 755 feet of BQ drilling in 15 holes. An additional 85 holes of JKS drilling, totalling 10 689 feet, was done, and over 2000 rib and back samples collected from the arsenopyrite, albitite, and HTAZ zones (P. Holmes, Stan West Mining Corporation, personal communication, 1988).

Victoria Porcupine Resources

Dewatering of the Naybob (Kenilworth) Mine in Ogden Township started in late 1987. A headframe was erected and by early 1988, when the project ceased due to financing problems, the shaft had been dewatered and rehabilitated to the 780-foot level. In 1988, surface diamond drilling totalled 1495 feet, out of a total program of 9495 feet (12 holes) which began in late 1987 and ended in early 1988. These holes were drilled to explore for possible extensions along strike of the south sulphide zone.

If the financing difficulties are solved, the shaft will be rehabilitated to the 1275-foot level and underground diamond drilling will be done (Victoria Porcupine Resources, personal communication, 1988).

Wabigoon Resources Incorporated—Master Resources and Development

In 1987, Wabigoon Resources Incorporated and Master Resources and Development formed a joint venture by which the latter company could earn a 50 percent interest in the Hunter Gold Mine owned by Wabigoon Resources, with an expenditure of $2 800 000. After an expenditure of $1 500 000 beginning in late 1987 and into mid-1988, Master Resources and Development could not raise the remaining $1 300 000.

Work on the property included the erection of a headframe over the old inclined shaft, the commissioning of a hoist, and dewatering the mine workings to the 400-foot level. Eight underground diamond-drill holes, totalling 3881 feet, were completed from the 275-foot level. Also, all the underground workings to 400 feet were geologically mapped. No work on the property was done in the latter part of 1988 after the expenditure of the initial $1 500 000 (John Kirwan, personal communication, 1988; personal observation, 1988; Northern Miner, May 30, 1988).

ABITIBI BELT EXPLORATION ACTIVITY

American Barrick Resources Corporation

American Barrick Resources made an agreement in early 1988 with HSK Minerals Limited to earn a 50 percent interest in the latter company's property in English and Beemer townships. The company is required to make a cash payment and to spend $1 000 000 over three years on the property.

In late 1987, HSK Minerals drilled 12 holes on the property. Subeconomic gold values were intersected in silicified sections of a wide shear zone near Muskasenda Lake. Options are also held on the adjacent N.J. Bellemare Mining Incorporated and Rainbow Explorations Limited properties.

Work done in 1988 by American Barrick included an airborne geophysical survey, geological mapping, and a few test lines of ground geophysics. At the time of writing, a diamond drilling program was ongoing with 4000 feet to have been completed by the end of 1988. Another 2400 feet of drilling will be done in early 1989. The drilling is on the previously known gold occurrence, airborne electromagnetic (EM) anomalies, and on surface gold showings discovered during the summer of 1988 (American Barrick Resources Corporation, personal communication, 1988).

Asarco Exploration Company of Canada Limited

In 1988, 15 exploratory diamond-drill holes (4082 m) were drilled in Macklem Township by Asarco Exploration Company of Canada Limited. Five of these holes were drilled to the north of the company's Aquarius Mine with negative results.

Five holes were drilled to the east of the mine, including two holes drilled into the gold-bearing felsite (albitic) body which was drilled in 1987. This body has been traced for 1400 m along strike. It has an average width of 26 m and an average gold grade of 1 g/t. The remaining three holes were drilled into a carbonate zone.

Another four holes were drilled within 300 m of the mine workings. One hole was drilled off the ice on Night Hawk Lake, with no positive results.

Asarco completed two diamond-drill holes totalling 372 m in the southern part of German Township. Greywacke, conglomerate, and diabase were intersected in the holes, but no gold values were reported.

Asarco drilled 17 reverse circulation holes in Carscallen Township and 16 reverse circulation holes in Fallon and Fasken townships. Backhoe trenching (195 m) was also done in Fallon and Fasken townships.

Seven backhoe trenches were dug in Robb Township, with negative results.

Ground geophysics was done in Keefer and Price townships.

An IP survey was done by River Oaks Gold Corporation on ground in Matheson Township optioned from Asarco Exploration (Asarco Exploration Company of Canada Limited, personal communication, 1988).

Aslan Exploration/Development Limited

After a program of geophysical surveys, a short 3-hole (300 m total) diamond drilling program was done in late 1988 on the company's 19-claim property just east of Kamiscotia Lake in Robb and Jamieson townships (John Kirwan, Consultant, personal communication, 1988).

Aumo Explorations Incorporated

Following up on a 25-hole reverse circulation drilling program completed in late 1987 on 9 claims south of Mahoney Lake in Denton Township, Aumo Explorations Incorporated conducted a 9-hole (1391 m total) diamond drilling program in early 1989. No results were published (R.J. Bradshaw, Consultant, personal communication, 1988).

BHP-Utah Mines Limited

Geological mapping and geophysical surveys were completed on the company's claims in east-central Whitney Township. Diamond drilling is planned for 1989 (BHP-Utah Mines Limited, personal communication, 1988).

Brightwest Resources Exploration Limited

Geophysical surveys were completed early in 1988 by Brightwest Resources Exploration Limited on their claims in Stock Township, one mile north of the St. Andrew Goldfields Mine.

In the fall of 1988, 32 reverse circulation holes were drilled at 500-foot intervals along north-south lines. These holes were drilled to bedrock going northward from sedimentary rocks into volcanic rocks (W.O. Karvinen, Consultant, personal communication, 1988).

Canamax Resources Incorporated

Nine surface diamond-drill holes (2733 m) were drilled on the optioned Vogel patented claims in Hoyle Township. The claims are west of, and adjacent to, the Owl Creek West gold deposit discovered by the Falconbridge Limited/Syngold Resources joint venture in late 1986. As well, the Canamax Resources exploration department drilled 13 holes (3363 m) on various targets in Hoyle and Murphy townships near the company's Bell Creek Gold Mine

(Canamax Resources Incorporated, personal communication, 1988).

Canhorn Mining Corporation

Geological mapping, and magnetometer and very low frequency electromagnetometer (VLF–EM) surveys were completed over 57 claims held by the company in the northwestern quarter of Jessop Township (Canhorn Mining Corporation, personal communication, 1988).

CAN–MAC Exploration Limited

CAN–MAC Exploration optioned two 60–claim properties from Kaphearst Resources, in Scholfield and Talbott townships. An exploration program of stripping, trenching, and diamond drilling was completed on selected areas of the two properties during the fall of 1988 (CAN–MAC Exploration Limited, personal communication, 1988).

Card Lake Resources

Card Lake Resources drilled two surface diamond–drill holes in the southwestern corner of the southern half of Lot 4, Concession I, German Township on patented ground optioned from K. Stringer. This program was a follow–up to previous overburden drilling done by the vendor. Bedrock chips from one of the overburden holes returned a gold assay of economic significance. The two diamond–drill holes were oriented at 360° with dips of 60° and 70° from the same setup, to test beneath this gold occurrence.

The first hole intersected a 5–foot section which assayed 0.259 ounce gold per ton at a depth of 306 feet to 311 feet. The intersection was within a 10–foot section of talc–chlorite–carbonate alteration of ultramafic rock containing from 5 to 15 percent disseminated cubic pyrite and fine disseminated magnetite.

This section appears to be a rafted block within a large fault zone which consists of disrupted talc–chlorite rock. The second hole hit a mud seam and was stopped (Personal observation, 1988; Steve Conquer, David Bell Geological Services, personal communication, 1988; Northern Miner, March 28, 1988).

Chevron Canada Resources Limited

In 1988, Chevron Canada Resources Limited conducted a surface diamond drilling program consisting of three holes (725 m total) on the company's claims in Price Township. Five backhoe trenches, each 150 m long, were also completed on the property (Chevron Canada Resources Limited, personal communication, 1988).

Cominco Limited

In 1988, Cominco drilled three holes on the Allerston Option in Bristol Township. Total drilling for this program, which lasted from late 1987 into early 1988, was seven holes (1853 m). No significant gold values were obtained and the property was returned to the vendor.

Three surface diamond–drill holes (594 m) were drilled on optioned patented claims in Lot 10, Concession IV, German Township.

A small bulk sample was taken from the Allerston talc–magnesite deposit in Whitney Township, held under option by Cominco. Beneficiation tests were conducted at Lakefield Laboratories. One surface diamond–drill hole (220 m) was drilled on the Allerston talc–magnesite property in Shaw Township (Cominco Limited, personal communication, 1988).

Comstate Resources

During 1988, Comstate Resources completed geological mapping, and magnetometer and horizontal–loop electromagnetic (HLEM) surveys over a 78–claim group in Reid and Thorburn townships. Additional work is planned for 1989. Geological mapping was completed over a 10–claim property in Jessop Township (D.R. Pyke, personal communication, 1988).

Consolidated Rio Plata Resources Limited

Consolidated Rio Plata Resources Limited optioned claims in Lots 1 and 2, Concession I and II, Matheson Township from G.T. Boissonneault. Line cutting, and magnetometer, gradiometer, and VLF–EM surveys were done. Three surface diamond–drill holes totalling 500 m were completed (Consolidated Rio Plata Resources Limited, personal communication, 1988).

Continental Precious Minerals

In 1987, Continental Precious Minerals completed ground magnetometer surveys on 25 unpatented claims in Tolmie Township which defined two probable circular intrusions. The company has also arranged a private placement of flow through shares worth up to $2 000 000, and has entered into an agreement with BP Resources Canada whereby it may acquire up to a 40 percent unsubdivided interest in claims which will be staked following a study on the diamond potential of Ontario. The joint venture partners plan to spend $3 500 000 on diamond exploration by 1990 (Resident Geologist's Files, Timmins; Northern Miner, November 30, 1987, October 3, 1988).

Dore Explorations Incorporated

In early 1988, Dore Explorations completed a VLF–EM survey on its 15–claim property in the Lower Detour Lake Area. The survey revealed a number of structural and lithological features with potential to host gold mineralization. A detailed ground magnetometer survey is planned for the property during the winter of 1989 (Resident Geologist's Files, Timmins, 1988).

Esso Minerals Canada

Esso Minerals Canada, in a joint venture with Torogold Resources Limited, completed 23 surface diamond–drill holes totalling 3610 m on the Robele joint venture property in the north–central part of Thorneloe Township. The property, originally staked in 1983, has had 10 800 m of diamond drilling done on it since 1985. Most of the drilling was concentrated on a zone which can be described as an elongated breccia pipe, 75 m long by 30 m wide which returned gold values. The pipe has an alteration assemblage of hematite, magnetite, and pyrite, which is indicative of a redox environment. The breccia pipe is within a porphyry which is within an east–west striking shear zone.

In 1988, Esso Minerals Canada, in a joint venture with Golden Penguin Resources, completed 12 surface diamond–drill holes totalling 2221 m on a former Hollinger Exploration property in east–central Denton Township. The property was drilled by Hollinger in 1982 and 1985. Esso Minerals drilled six holes into the Wakemac Shear, a quartz–sericite schist within tholeiitic rocks at the eastern end of a diorite/granodiorite intrusion. An additional six holes were drilled farther to the southeast into the Scott Shear, a ductile shear zone at the contact between altered tholeiites to the north and altered komatiites to the south. Narrow erratic gold intersections were obtained from both zones.

Esso Minerals Canada also conducted an IP survey, stripping, mapping, and sampling on claims in English and Zavitz townships.

In September, 1988, Imperial Oil Limited announced plans to sell Esso Minerals Canada. The company would prefer to sell its mineral holdings as a block, but if a buyer cannot be found, it may study selling them in a piecemeal fashion (Northern Miner, September 26, 1988; Esso Minerals Canada, personal communication, 1988).

Falconbridge Limited

Falconbridge Limited, during 1988, continued to be the most active organization exploring in the Timmins area. The company completed diamond drilling programs in 17 townships with 198 holes totalling 68 153 m drilled. The total metres drilled in 1988 represented an increase of 1846 m over the 1987 figures which were in turn a 50 percent increase over footages drilled in 1986.

In 1986, exploratory drilling for base metals represented only 16 percent of total drilling done. In 1987, the figure had increased to 48 percent, and in 1988, 73 percent of total exploratory drilling was for base metals. The dramatic increase in base metal exploratory drilling illustrates the firm's mandate to find an additional source of feed for its metallurgical complex in Timmins. Ore produced from the Kidd Creek Mine has already exceeded the 1985 proven ore reserve figures.

Exploratory drilling for base metals was in general divided between the Kidd Township area and the Kamiskotia area.

Kidd Township Area Base Metal Exploratory Drilling

Township	Drill Holes	Metres
Carnegie	12	4936
Kidd	21	6654
Wark	2	521
Reid	1	296
Macdiarmid	2	717
Prosser	46	18 566
Kamiskotia Area Base Metal Exploratory Drilling		
Jamieson	3	968
Godfrey	25	10 282 *
Mahaffy	8	3969
Loveland	5	1357
Macdiarmid	2	654
Geary	2	676

* *includes drilling on the Genex and Canadian Jamieson Mine properties.*

Exploration diamond drilling for gold was carried out in Tisdale Township, 1 hole (300 m); Cody Township, 6 holes (1789 m); and Matheson Township, 12 holes (4045 m). Drilling in Whitney Township, 19 holes (3776 m), was confined to exploration of the Hoyle Gold Mine property owned by Falconbridge Limited. Both the sedimentary rocks east of, and along strike of, the No. 3 pit of Giant Yellowknife Mines Limited, and the volcanic rocks to the north of the pit were tested. In Hoyle Township, 31 holes (8647 m) were drilled. Areas explored included an area to the west of the Vogel Property (optioned by Canamax Resources); and an area north of the Owl Creek Mine, along strike with and to the east of, the volcano–sedimentary contact which hosts the Bell Creek Deposit (Falconbridge Limited, personal communication, 1988).

FinNeth Exploration Incorporated

FinNeth Exploration Incorporated drilled one 100 m hole to test an EM conductor, located on claims in Carscallen Township optioned from C. Morgan. Barren pyrrhotite was intersected and the claims were returned to the optioner (FinNeth

Exploration Incorporation, personal communication, 1988).

Glen Auden Resources Limited—Mineta Resources Limited—Royex Gold Mining Corporation Joint Venture

In 1988, a reverse circulation drilling program and an IP survey were carried out on the property of joint venture partners Glen Auden Resources and Mineta Resources. Twenty claims of the 285–claim property are situated in the Lower Detour Lake Area, Ontario, contiguous with the Massicotte Township, Quebec, claim block.

A total of 37 reverse circulation holes were drilled in the vicinity of two airborne EM anomalies and a linear magnetic "break". Three of the five holes (totalling 554 feet) drilled on the Ontario claims returned significant gold grain counts (10 to 15 grains) from basal till samples, with the best heavy mineral fraction assaying 1030 ppb gold.

A follow–up IP survey investigated areas around the two EM anomalies for disseminated sulphides and was successful in outlining two zones coincident with previously detected HLEM conductors.

Royex has been given an option to earn a 50 percent interest in the claims in the Detour Lake area held jointly by Glen Auden, Mineta, and Golden Dragon Resources. Royex is to spend $1 600 000 on exploration and $195 000 in option payments over two years. On an additional property in the same area, Royex has agreed to spend $4 000 000 to earn a 50 percent interest, with Glen Auden and Golden Dragon contributing $2 000 000 to exploration. Once this interest has been earned, Royex will be responsible for financing all further expenditures to bring this property into production (Resident Geologist's Files, Timmins; Work Permits; The Globe and Mail, June 23, 1988; Glen Auden Resources Limited, personal communication, 1988).

Golden Pheasant Resources Limited

In early 1988, Golden Pheasant Resources Limited completed three diamond–drill holes totalling 1000 feet on a 36–claim property straddling the boundary between Carman and Langmuir townships. The exploration target was an IP anomaly, outlined in early 1988, associated with a 1962 diamond–drill hole which included a narrow intersection which contained copper, silver, and gold values. Sulphides were intersected, but no significant gold values were found. In the fall of 1988, a program of line cutting, geological mapping, and IP surveying was done. As of December 1988, four holes, totalling 2500 feet, had been drilled on the property (George Cross News Letter, April 5, 29, 1988; Roberta Bald, Consultant, personal communication, 1988).

Goldfields Canadian Mining Limited

In 1988, geological mapping and geochemical sampling were done on the property of Goldfields Canadian Mining Limited which straddles the boundary between Tisdale and Whitney townships. Four holes totalling 10 248 feet were drilled on the property, one of which was an extension of a 986–foot hole drilled in 1987. The seven claims are optioned from David Meunier.

In Zavitz and Hutt townships, the company conducted rock sampling, geological mapping, prospecting, and humus sampling.

On the Leblanc Option, in English Township, Goldfields Canadian Mining Limited conducted geological mapping, sampling, prospecting, and humus sampling (Goldfields Canadian Mining Limited, personal communication, 1988).

Gowest Amalgamated Resources Limited—Jonpol Explorations Limited

Twelve surface diamond–drill holes totalling 2160 m were drilled by the joint venture partners in Denton Township. This was a follow–up to a 42–hole overburden drilling program conducted by the company in late 1987 and early 1988. No further diamond drilling was done on the known gold zone previously drilled in 1987. In one location, a 15 m zone of sericitized felsic volcanic rocks containing pyrite and arsenopyrite with anomalous gold values was intersected. In another location, narrow widths of pyrite and arsenopyrite mineralization with subeconomic gold values were intersected in chloritic mafic volcanic rocks (Gowest Amalgamated Resources Limited, personal communication, 1988).

Granges Exploration Limited

Granges Exploration Limited completed six diamond–drill holes in Turnbull Township to test EM conductors for base metals. Also, five holes were drilled in Jessop Township. Graphite or barren pyrrhotite was intersected in all holes (Granges Exploration Limited, personal communication, 1988).

HSK Minerals Limited

During the fall of 1988, HSK Minerals participated in a surface exploration and diamond drilling program over its 971–claim property in Doherty and Pelletier townships. HSK Minerals was the operator of the property and held a 25 percent working interest along with joint venture partners, Noront Resources Limited, X–Cal Resources Limited, and a private investor. Noront Resources has since sold its 25 percent interest in the property to Joutel Resources Limited (Canadian Mines Handbook, 1988–1989; Noront Resources Annual Report, 1987).

Highwood Resources Limited—Minteck Resources Limited

In late 1987, Highwood Resources drilled four diamond–drill holes on property in Bristol Township optioned from J. Croxall. The best intersection was 3.6 feet grading 0.162 ounce gold per ton within a 30–foot zone of anomalous gold values. The zone had been previously drilled by Preussag Limited who held the option in 1981.

Highwood Resources originally became interested in the 63 claims in 1986 for their rare earth potential. However, the company subsequently decided to follow–up Preussag's gold exploration results. In mid–1988 Highwood made an agreement with Minteck Resources who can earn a 70 percent interest in the property. In the fall of 1988, a backhoe trenching program was done by Minteck, in an attempt to locate the projected gold intersection on surface and to clean out and examine old trenches (J. Croxall, personal communication, 1988; George Cross News Letter, June 16, July 6, 1988).

L. Hill

Prospector and retired diamond driller, Len Hill, drilled three surface diamond–drill holes totalling 609 feet in 1988 on his claims in Mann Township. This follows a two–hole, 251–foot diamond drilling program done in 1987. Platinum mineralization was the exploration target. Peridotite and pyroxenite were intersected (Len Hill, personal communication, 1988; Assessment Files, 1988).

Hutchison Resources Incorporated

Magnetic and HLEM ground geophysical surveys were carried out on the Hutchison Resources Property during 1988. The 54–claim property, which was optioned from Kaphearst Resources Corporation, is located in the west–central part of Scholfield Township immediately north of the Mattawaitchewan River. The ground EM survey located several conductors that are to be tested by drilling (Resident Geologist's Files, Timmins, 1988).

Inco Gold Company

Inco Gold Company optioned 35 claims in the southeastern corner of McArthur Township and the northeastern corner of Bartlett Township from Norwin Resources. Geological and geophysical surveys were done in 1988 (Inco Gold Company, personal communication, 1988).

Kaphearst Resources Corporation

Kaphearst Resources Corporation allowed 1137 of its claims in Scholfield, Talbott, Ebbs and Roche townships area to lapse. This reduces the number of claims in good standing in the company's block to 1655. Diamond drilling in Scholfield Township was expected to commence in December 1988 (George Cross News Letter, July 29, 1988).

Ressources Kimex Incorporated

The company acquired 60 claims in Timmins and Sheraton townships in 1988. To date, line cutting, and magnetometer and VLF–EM surveys have been done on the property. Diamond drilling is planned for the winter of 1988–1989 (Ressources Kimex Incorporated, personal communication, 1988).

Lac Minerals Limited

A small program consisting of line cutting and geophysical surveys was conducted by Lac Minerals on their property in Sheraton Township (Lac Minerals Limited, personal communication, 1988).

The Lithium Corporation of Canada Limited

To the end of August 1988, the Lithium Corporation of Canada Limited conducted geological mapping, surface sampling, and an 18–hole surface diamond drilling program (approximately 13 000 feet total) on claims optioned from R. Allerston and on patented claims owned by Noranda Exploration in Whitney Township. This program was part of a joint venture with Noranda Exploration. The Lithium Corporation, which was the operator, earned a 60 percent interest in both properties by financing the work program. Zones with anomalous gold and base–metal values were outlined. Noranda will be financing the next phase of exploration and will be the operator (The Lithium Corporation of Canada Limited, personal communication, 1988).

Lucas Gold Resources Limited

Lucas Gold Resources Limited optioned a gold deposit in Lucas Township from Abitibi Price Inc. in late 1986. In 1987, Lucas Gold Resources drilled three surface diamond–drill holes. In 1988, in order to prepare accurate plans and sections, the company had "Sperry Sun" surveys completed on 29 out of the 50 holes that were previously drilled into the deposit. Additional drilling is planned for 1989. No reserve calculations have been made since 1982, when the mineral inventory was estimated to be 235 000 tons grading 0.10 ounce gold per ton (W.O. Karvinen, Consultant, personal communication, 1988).

McKinnon Prospecting

Airborne magnetic and VLF–EM surveys were flown over five separate claim blocks held by McKinnon Prospecting, including property in Casselman and Slack townships; Auden Township and Pitopiko River Area; and the largest block, in Hurdman, Beardmore, Alexandra, and Machin townships. The survey outlined 23 conductive zones. Since the magnetic relief is high on the property, a combined gradient–total–field magnetic survey will be carried out to delineate geology, contacts, and structures.

On its property in Machin, Fauquier, and Shackleton townships, McKinnon Prospecting outlined two probable fault zones with the magnetic survey. These will be further tested by ground geophysical surveys.

In Valentine and Kilmer townships, the VLF–EM survey outlined two conductive zones on the 13–claim property. Kimberlitic rocks have also been discovered and it is hoped that planned ground geophysical surveys will pinpoint the locations of these rocks (Resident Geologist's Files, Timmins, 1988).

Mill City Gold Incorporated

Mill City Gold carried out exploration programs on several properties in the Timmins area during 1988. On the Excello Property option in northern Shaw and Deloro townships, 16 km of line cutting, magnetometer, VLF–EM, and IP surveys were completed. A six-hole, 930 m surface diamond drilling program was then carried out to test geophysical anomalies. The property was subsequently returned to Tyranex Gold Incorporated, who then mapped the geology of the property. Possible work in 1989 includes dewatering the old mine and resampling the underground workings.

Mill City Gold completed 22.5 km of line cutting and ground geophysics on their Whitney Township property. This was followed by a 26-hole reverse circulation drilling program to test down–ice from geophysical anomalies (E.H. Van Hees, Geological Services Incorporated, for Mill City Gold Incorporated, personal communication, 1988).

W. Miller

In the fall of 1988, W. Miller discovered a graphite showing while prospecting on his six–claim property in Foch Township. A series of *en echelon* graphite–rich horizons within east–striking metaquartzites have been exposed by stripping. Further work is planned to expose the geology and to delineate the graphite–rich zones (Personal observation, W. Miller, Prospector, personal communication, 1988).

Musto Explorations Limited

In 1987, the company acquired ground covering the Nemogosenda Lake Carbonatite Complex in Collins and Chewett townships. Following a very detailed airborne geophysical survey of the property in 1987, road access was completed and surface sampling of existing trenches was done in 1988. The property has now reverted back to Eastmaque Gold Mines Limited (Musto Explorations Limited, personal communication, 1988).

Newmont Exploration of Canada Limited

In late August and early September, Newmont Exploration drilled six surface diamond–drill holes (4200 feet total) on property optioned from QZZ Incorporated (formerly Brown McDade Resources Limited) in Denton and Keefer townships. This was a follow–up to three holes drilled in 1987. Geophysical surveys were also done on adjoining claims. More work is planned for 1989 (Newmont Exploration of Canada Limited, personal communication, 1988).

Noranda Exploration Company, Limited

In 1988, Noranda Exploration Company, Limited drilled 11 surface diamond–drill holes totalling 4100 m, on a gold zone close to the Timmins landfill site and along the border between Deloro and Ogden townships. Noranda Exploration discovered this large zone of gold–bearing quartz–carbonate veins in 1986. Erratically distributed gold values have been intersected and no reserve calculations have been made.

In a program to explore the Tisdale Group to the south of the Deloro Group, Noranda Exploration drilled five holes, 1000 m in total, on a 180–claim group in the northeastern corner of Adams Township. This has been described as a long term exploration project.

Noranda Exploration, in a joint venture with McChip Resources, drilled 12 holes, 3600 m in total, on properties in German, Macklem, and Stock townships. Of these, four holes (1200 m) were drilled into the gold–bearing felsic body on property optioned from Canarchon Holdings Limited (formerly Pominex Limited). Gold intersections were reported in early 1988. The other holes were drilled to the north and into the Porcupine Destor Fault Zone to explore for mineralization similar to that found at the St. Andrew Goldfields Mine in Stock Township. Two, narrow, high–grade gold intersections with visible gold were reportedly obtained in Stock Township in previously unexplored ground.

Noranda Exploration has started grassroots base–metal exploration projects to the northwest of Timmins on 600 claims staked before and after the Ontario Geological Survey, Timmins Area, Airborne Electromagnetic Survey was released in March. Some of the claims were staked as a result of the release.

Noranda Exploration's 1988 program also included the drilling of eight holes totalling 2000 m in the Fox River, Pivabiska River, and Renesig Creek areas. The holes were drilled to test several zones of high magnetic relief and conductivity outlined by a previous geophysical survey. Hole FR–88–4 intersected a 2 m zone of 20 to 25 percent pyrrhotite in a graphitic metasiltstone.

The company completed an additional 1561.2 m of diamond drilling on its Lower Detour Lake Area property. Funding for the project was provided by joint venture partner, Next Door Resources. The seven holes drilled into EM targets intersected graphite and pyrite in sediments (Resident Geologist's Files, Timmins; Work Permit; Noranda Exploration, personal communication, 1988; Northern Miner, January 18, 1988).

Pamorex Minerals Incorporated

In early 1988, it was agreed that Pamorex Minerals would acquire the exploration properties belonging to Giant Yellowknife Mines Limited and Pamour Inc. As a result of the company's sale of its share of the Bell Creek Mine to Canamax Resources Incorporated for $16 500 000, Pamorex paid $1 832 500 cash to Giant Yellowknife Mines Limited and $1 288 000 to Pamour Inc. in full consideration of these acquisitions.

Pamorex Minerals Incorporated conducted an extensive exploration program on the south end of the North Peninsula of Night Hawk Lake. This property straddles the boundary between Cody and Macklem townships. In 1988, 35 000 feet of surface diamond drilling was done. Drilling was concentrated west of the Porcupine Peninsular Property and in the Deadman's Island area. In the late summer and fall, 19 000 feet of drilling was completed from a barge on the lake.

Surface trenching and sampling was done on several small islands just off the peninsula. Gold mineralization was uncovered. All of the above work was done along-strike from the gold-bearing structure on the former Porcupine Peninsular Mine. From an underground exploration program done on the mine in 1986-1987, an inferred mineral inventory in the mine is estimated to be 1 270 000 tons grading 3.2 g/t gold. The company is planning another extensive program of drilling, stripping, and sampling in the area, as well as a further development exploration program at the Porcupine Peninsular Mine in 1989.

In Tisdale Township, Pamorex Minerals completed 6500 feet of surface diamond drilling on two properties. These properties were optioned from Falconbridge Limited who obtained the properties through their interest in McIntyre Mines Limited.

Deep drilling was done immediately east of the Coniaurum Mine to test a hypothesis that carbonate alteration found on surface may be due to an intrusive porphyry at depth, which may have gold mineralization associated with it. Quartz-ankerite veins and stringers were intersected, with the best assay being 0.58 ounce gold per ton over 3 feet 1600 feet below surface, and 2200 feet down the hole.

On the Chisholm claims, which lie west of, and adjacent to, the Vedron-Belmoral underground exploration project, two parallel sericite-quartz-carbonate shear zones containing pyrite were intersected by three holes. The best result was 0.20 ounce gold per ton over 4 feet.

In the northern part of Matheson Township, Pamorex carried out 3500 feet of surface diamond drilling. Line cutting and geophysical surveys were done in Byers, Moberly, and Newmarket townships (Pamorex Minerals Incorporated, personal communication, 1988; Northern Miner, March 7, 1988; Pamorex Minerals Incorporated Annual Report, March 31, 1988).

Peter Island Resources Limited

Peter Island Resources Limited drilled three diamond-drill holes totalling 3504 feet, in early 1988, on property in Tisdale Township optioned from August Porcupine Mines Limited (W. MacRae, Consultant, personal communication, 1988).

Placer Dome Incorporated

Placer Dome Incorporated carried out two surface diamond drilling programs on their wholly-owned claims in Bristol Township in 1988. One began in May, the other in October, on a 120-claim property in the southeastern corner of the township. A total of 7700 m was drilled. As well, a magnetic survey and 600 m of diamond drilling were done on six adjacent optioned claims. Farther to the east, in Ogden Township, magnetic and IP surveys were done along with 1200 m of diamond drilling on eight optioned claims. Placer Dome has been drilling in the area since 1985. The target has been porphyry surrounded by sedimentary rocks. Erratic gold values have been intersected but no continuous zone of gold mineralization has been outlined.

On their gold claims in Thomas Township, the company completed one 405 m diamond-drill hole, as well as a mapping and sampling program.

An eight-hole 1000 m, diamond drilling program was completed in early 1988 on the company's claims in Sothman Township. Electromagnetic conductors were the drill targets.

On Placer Dome's joint venture exploration program with Melrose Resources (Placer Dome 60 percent, Melrose 40 percent) in Langmuir and Blackstock townships, 3500 m, in 16 holes, were drilled in late 1988 after a 40 line-kilometre IP survey. To earn its interest in the property, Placer Dome has reportedly spent $1 000 000 in the last few years.

A 900 m diamond drilling program was also done on the company's wholly-owned claims in Langmuir Township. An IP survey was done in English and Semple townships.

In 1988, the company also did line cutting and geophysical surveys in Newmarket, Carscallen, Lucas, McCart, Cote, Loveland, Jamieson, and Thorneloe townships. All the staking in these townships resulted from the Government of Ontario release of airborne electomagnetic and magnetic survey maps in March 1988 (Placer Dome Incorporated, personal communications, 1988; Northern Miner, various articles, 1988).

Sheridan Geophysics Limited

Geophysical surveys were conducted by Sheridan Geophysics on its owned and optioned properties in Kidd, Wark, Murphy, and Jessop townships. Backhoe stripping and trenching were carried out in Wark and Cody townships (Sheridan Geophysics Limited, personal communication, 1988).

R.G. Smith

During October 1988, a diamond drilling program was completed on the 29–claim property of R.G. Smith in McCowan Township. Six holes totalling 3000 feet were drilled to test for auriferous quartz veining within metagreywackes (personal communication, 1988).

Stockgold Resources

In late 1987, Stockgold Resources completed a three–hole, 575 m, diamond drilling program on 40 claims in eastern Stock Township. The claims were held under an option which was dropped early in 1988 when no economically significant gold assays were obtained (Northern Miner, February 15, 1988; Assessment Files, Timmins Resident Geologist's Office, 1988).

Syngold Exploration Incorporated—Platinova Resources Limited

A ten–hole, 5000–foot, surface diamond drilling program was completed on the 14 claims held by the joint venture partners. The claims straddle Highway 101 just south of the Hallnor and Pamour Number One Mine properties in Whitney Township. The drilling followed geological mapping and compilation and geophysical surveying done in late 1987. The holes were drilled north of the Porcupine–Destor Fault Zone on what was initially considered to be the fault zone. Plans were to intersect the komatiite–sediments contact. More komatiites were intersected than anticipated due to the low magnetic response of some of the altered areas. Some of these alteration zones returned anomalous gold values. The companies feel that more work is warranted on the property and has tentative plans for more work in 1989 (Syngold Exploration Incorporated, personal communication, 1988).

TME Resources Incorporated—Esperanto Resources Limited

TME Resources made a joint venture agreement with Esperanto Resources by which the latter company was to spend $100 000 to earn a 65 percent interest in the former company's 11–claim property in Denton Township. This property was optioned originally from W.O. Karvinen. IP and VLF–EM surveys were completed in early 1988. A stripping and trenching program was done in June 1988. Diamond drilling is planned for early 1989 (George Cross News Letter, December 9, 1987; W.O. Karvinen, personal communication, 1988).

Total Energold Corporation

Total Energold Corporation optioned a number of claims in the northeastern part of Shaw Township and the southeastern part of Whitney Township. The Goose Lake road, which runs through part of the property, was rehabilitated. Geological mapping, magnetometer, and VLF–EM and HLEM surveys and 120 km of line cutting were done. A total of 1500 samples collected from plugger hole cuttings and rock chip samples were sent for whole rock analyses (R. Somerville, Consultant, personal communication, 1988).

Ventex Energy Limited

Geological mapping and VLF–EM surveys were completed over the company's 82 contiguous claims in southern Thomas and Sheraton townships in mid–1988 (Exsics Exploration, personal communication, 1988).

Westmin Resources Limited

A VLF–EM geophysical survey was completed on the four–claim property held by Westmin Resources in the Lower Detour Lake Area in 1988. The survey identified three weak conductors that are to be further tested by ground geophysics (Resident Geologist's Files, Timmins, 1988).

Other Exploration Activity

Unless otherwise stated, information in this part of the report was obtained from personal communications with the parties involved.

A. Decker completed stripping, trenching, and line cutting on his property in Hutt Township.

B.A. Ellies completed a short "packsack" drillhole on his property in northwestern Tisdale Township. No economic mineralization was reported.

F. Harvey and W. Martin continued a blasting and sampling program on iron formations located on a five–claim property in Deloro Township.

C. Morgan completed trenching and sampling on his property in Turnbull Township.

R. Tremblay completed trenching and sampling on his claims in Sewell Township.

Glen Auden Resources Limited drilled three holes and completed line cutting and geophysical surveys on optioned ground in the southern part of Jessop Township.

Keefer Lake Resources completed an exploration program on the company's claims in southwestern Denton Township.

Kingswood Exploration completed a stripping program on part of their 39–claim property in

Deloro Township. Geological and geophysical surveys are planned.

Seeley Lake Resources drilled four holes to test sulphide facies iron formation on the northern boundary of Shaw Township. No economic mineralization was intersected.

Tarzan Gold Incorporated completed ground magnetometer surveys over the company's ten claims in Clergue Township.

SWAYZE BELT EXPLORATION ACTIVITY

Actuate Resources

Line cutting and a ground magnetic survey were completed on a 57-claim property in Benneweis Township. Copper and nickel values had been reported from previous sampling. Actuate Resources is evaluating the property for platinum, gold, copper, and nickel potential (Actuate Resources, personal communication, 1988; Work Permit, 1988).

BHP-Utah Mines Limited—Orvana Resources Incorporated

Soil geochemistry and IP surveys were carried out over the north and west parts of the partners' 67-claim Boulder Lake Property in Muskego and Keith townships. A diamond drilling program scheduled for 1988 was deferred until 1989. Several new drill targets have been identified (BHP-Utah Mines Limited, personal communication, 1988).

Blue Falcon Mines Limited

Blue Falcon Mines completed geological mapping on 64 unpatented claims in central Benneweis Township. The east half of the property is underlain by multi-phase intrusive rocks of dioritic to gabbroic composition containing abundant mafic xenoliths. Sulphide mineralization consisting of trace to five percent pyrite and one to two percent chalcopyrite occurs locally both within, and peripheral to, the gabbro-diorite rocks. The property is being evaluated for gold and platinum group element potential (Blue Falcon Mines Limited, personal communication, 1988; Resident Geologist's Files, Timmins).

Bond Gold Canada Incorporated (formerly St. Joe Canada Incorporated)—Giant Bay Resources Limited

A six-hole, 853.6 m diamond drilling program was carried out during the period of December 1987, to January 1988, on a 37-claim group in central Horwood Township. The drill targets were two surface gold showings located on Pinecone Point on Horwood Lake. Three holes were drilled to test the "A" Zone near the south end of Pinecone Point and three holes were drilled on the "B" Zone, at the north end of the point. No significant gold values were reported.

Several gold exploration targets remain to be tested and further work is planned (Bond Gold Canada Incorporated, personal communication, 1988; Resident Geologist's Files, Timmins).

BP Canada Incorporated

Early in 1988, IP surveys were carried out over the eastern part of a 178-claim group in Keith and Muskego townships. The survey outlined several targets for further evaluation. An 11-hole diamond drilling program totalling 2176 m was completed. Drill targets were coincident IP anomalies and arsenic till anomalies outlined in 1987. No significant mineralization was intersected (Resident Geologist's Files, Timmins; BP Canada Incorporated, personal communication, 1988).

Bryndon Ventures Incorporated

Early in 1988, Bryndon Ventures carried out a soil geochemistry survey over the northern portion of their 48-claim Kingbird Property in northwestern Yeo Township. The survey results indicated a subtle clustering of elevated gold values in shallow basal tills from the northwest part of the property. Additional groundwork has been recommended (Resident Geologist's Files, Timmins, 1988).

Canadian Gold Resources Incorporated

Early in 1988, one diamond-drill hole totalling 117 m was completed on Canadian Gold Resources' Osway Township claims. The hole tested a sequence of variably carbonatized and sericitized, mafic to felsic tuffs mineralized with pyrite and pyrrhotite. No significant gold values were reported (Resident Geologist's Files, Timmins, 1988).

CAN-MAC Explorations Limited—Glen Auden Resources Limited

CAN-MAC Explorations and Glen Auden Resources are joint venture partners on three gold properties in Swayze and Denyes townships.

On the 32-claim Saxton Lake Property in central Swayze Township, extensive stripping and trenching were completed early in 1988. Minor anomalous gold values were obtained. No further work is planned.

Extensive stripping and trenching were carried out on the 42-claim Topboot Lake group on the Swayze-Denyes township boundary. Initial channel sampling during the winter stripping program outlined the Derraugh Vein structure for 100 m along trend. Subsequent stripping and sampling increased the strike length to 200 m.

The vein system is characterized by a steeply dipping, 3 to 6 m wide, 150° to 160° trending, sericite-carbonate shear zone in a massive, well-jointed feldspar porphyry intrusion or thick flow. Within the shear, gold is associated with a large, relatively continuous, quartz–carbonate vein up to 1.3 m wide, and smaller, discontinuous quartz–carbonate veinlets and stockworks occurring over widths of up to 4 m. The sulphide content of the vein zone averages less than one percent pyrite and chalcopyrite with concentrations of up to 10 percent sulphides occurring locally in the vein material. Gold distribution in the vein zone is erratic, with the best values reported being associated with chalcopyrite. Pyritic sections returned subeconomic but anomalous gold values. The vein zone is truncated at the south end by a northeast–trending cross fault. The north end is open.

The No. 2 vein is located 250 m northwest of the Derraugh Vein. Host rocks, structure, and alteration are very similar to those of the Derraugh Vein. The No. 2 vein has been exposed for 50 m along a 160° trending, sericite–carbonated shear. The southern end has been truncated by a strong, 060° trending cross fault, and the northern end continues under a swamp. Initial sampling returned anomalous gold values associated with pyrite mineralization.

Stripping on the No. 3 Vein zone revealed a 3 m wide, 060° trending, rusty, mineralized shear cutting a northeast–trending diorite dike. A discontinuous lens of semi–massive pyrite, 3.7 m long and 1.2 m wide, was exposed in the shear. Erratic anomalous gold values were obtained from narrow, massive pyrite stringers within the sulphide–rich lens. No further work is planned on the No. 3 Zone.

Following completion of the surface evaluation program, CAN–MAC drilled 13 holes totalling 1220 m on the Derraugh and No. 2 Vein zones. The program confirmed the continuity at depth of the Derraugh and No. 2 Vein structures, but assay results were subeconomic.

Evaluation of the 76–claim Sylvanite Prospect claim group in northwestern Denyes Township is in the preliminary stage. An airborne magnetometer and VLF–EM survey was completed over the property in May 1988. Reconnaissance mapping was carried out near the Sylvanite showing, and a 9 km access road was constructed from the southern boundary of the Topboot Lake claim group. Limited stripping and trenching were completed over the showing.

Additional work is planned for the Topboot and Sylvanite claim groups in 1989 (Can–Mac Explorations Limited, personal communication, 1988; Northern Miner Press, February 15, April 11, 1988; George Cross News Letter, February 12, April 8, 1988; The Daily Press, March 10, August 17, 1988).

Charet Syndicate

The Charet Syndicate flew 733 line–kilometres of airborne geophysical surveys over a 250–claim property in eastern Dore and south–central Swayze townships, and over a 70–claim property in southeastern Dore Township. Following the survey, line cutting, prospecting, and geological mapping were carried out over selected areas. Additional work is planned following an evaluation of work done to date. At least two gold occurrences have been documented on the claims in Swayze Township (Resident Geologist's Files, Timmins; Charet Syndicate, personal communication, 1988).

Chesbar Resources Incorporated

Early in 1988, Chesbar Resources carried out a 21–hole surface diamond drilling program totalling 1669 m on the eight–claim Black Option in Chester and Yeo townships. Drill targets were linear magnetic highs believed to be chlorite–magnetite–bearing shears, and VLF–EM anomalies believed to be sulphide–bearing shears within the granodiorite intrusive body underlying the southern two–thirds of the property. Surface exposures of mineralized quartz–pyrite–chalcopyrite–magnetite veins were also drilled. Results of the drilling program have not been released (Chesbar Resources Incorporated, personal communication, 1988).

Consolidated Silver Butte Mines Limited

A VLF–EM survey was carried out on a 13–claim group in northwestern Osway Township. A stripping program was undertaken later in the year, and late in 1988 a diamond drilling program was in progress (Resident Geologist's Files, Timmins, personal observation, 1988).

Continental Precious Metals Incorporated

Line cutting, and magnetic and VLF–EM surveys were completed on 30 claims the company holds in southeastern Horwood Township. The property is being evaluated for its gold potential as its geology is similar to that of the Orofino Resources' Silk Township deposit (Resident Geologist's Files, Timmins, 1988).

Dore Norbaska Resources Incorporated

Line cutting and ground geophysical surveys were done on a 36–claim property in southeastern Swayze Township and southwestern Dore Township. Further evaluation is planned for 1989 (Resident Geologist's Files, Timmins, 1988).

Emerald Isle Resources Incorporated

A seven–hole, 379.5 m drilling program was completed late in 1987 on the company's nine–claim property in Chester Township. Two mineralized, northwest–trending structures, approximately 400 m apart, cut the property. Pyritic quartz veins, and pyritic stringers and fracture–fillings were intersected in both zones. No values were reported (D. Constable Consulting Incorporated, personal communication, 1988).

Glen Auden Resources Limited—Goldrock Resources Incorporated

Glen Auden Resources and Goldrock Resources are joint venture partners on a 22–claim property in west–central Keith Township, and on a 178–claim property in west–central Penhorwood Township. Early in 1988, the partners completed a detailed, 896 line–kilometre helicopter–borne geophysical survey on the two claim blocks.

The Keith Township claim group covers the projected westward extension of the structure hosting the Joburke Mine gold deposit which is located 3.5 km to the east. The Penhorwood Township claim group covers the on–strike extensions of the Kukatush iron deposit and the Primer Lake gold and base–metal occurrences.

The airborne survey outlined numerous targets and a follow–up exploration program is planned for 1989 (Glen Auden Resources Limited, personal communication, 1988; Resident Geologist's Files, Timmins).

Glen Auden Resources and Goldrock Resources are joint venture partners on the 385–claim Reeves Joint Venture Property located in the four–corners area of Kenogaming, Penhorwood, Reeves, and Sewell townships. Geological mapping, geophysical surveys, trenching, stripping, and sampling programs which were started in 1987 continued in 1988. The work outlined two major zones of high–strain deformation and carbonate alteration, considered to be a favourable geologic setting for gold mineralization.

The Deerfoot Lake deformation zone trends in a westerly direction through the four–corners area of the property. Extensive stripping and trenching focused on this area. The deformation zone is 100 to 200 m wide, and is characterized by a series of anastomosing, highly carbonatized, ductile shears and relatively uncarbonatized, chloritic, variably–foliated mafic metavolcanics. Disseminated pyrite concentrations occur locally within the deformation zone. Assays indicate anomalous gold values are associated with the pyrite. Late in the current field season, a narrow, gently–dipping, folded quartz–carbonate vein, mineralized with pyrite, chalcopyrite, and free gold was discovered in southeastern Reeves Township.

This vein occurs along the contact between highly altered and deformed mafic metavolcanics, and less altered, massive mafic flows. Additional stripping and sampling are planned for the showing.

The Fuchsite Zone is located 2000 m south of, and trends parallel to, the Deerfoot Lake deformation zone. It is characterized by intense chlorite–fuchsite–carbonate–talc alteration in strongly sheared, mafic and ultramafic metavolcanics. Large, barren, quartz–carbonate veins and stockworks are common within the sheared and altered rocks, but sulphide mineralization is rare or absent. No significant gold assays have been reported from this zone.

On the Tremblay Option in southwestern Sewell Township, two gold–bearing zones have been identified. Recent stripping southwest of Sewell Lake has exposed several narrow, closely spaced, north– to northwest–trending quartz veins cutting massive gabbro–diorite. Gold is associated with galena, pyrite, chalcopyrite, and sphalerite in the quartz veins. The zone has been traced for 365 m along trend. Near the western boundary of the Tremblay Option claims, economically significant gold values were obtained from a north– to northwest–trending band of interflow tuffs and iron formation. Base–metal sulphide mineralization also occurs in this unit. Additional work is planned for both zones.

Much of the larger claim group is in the early stages of evaluation. In addition to surface gold showings, numerous geophysical targets have been identified. The joint venture partners believe the rock types and structures present on the Reeves Joint Venture Property correlate with those of the Timmins Camp. The next stage of evaluation will include detailed stripping, mapping, and sampling of the known gold occurrences; continued evaluation of the unexplored portions of the property; and diamond drilling of geophysical and geological targets (R.S. Middleton Exploration Services Limited, personal communication; George Cross News Letter, February 12, 1988 and September 29, 1988; Northern Miner Press, October 17, 1988; The Daily Press, March 10, 1988 and October 17, 1988).

Grand American Minerals Limited

Ground geophysical surveys, geological mapping, and lithogeochemical sampling were completed on the 17–claim property held by Grand American Minerals in central Cunningham Township. The claim group lies between Falconbridge Limited's base–metal deposit (100 000 tons of 3 percent zinc, 1 percent lead, and 0.5 percent copper) and the MW Resources' (formerly Consolidated Shunsby) base–metal deposit (2 400 000 t of 2.37 percent zinc, 0.39 percent copper).

Reconnaissance work by Grand American Minerals indicated several base–metal occurrences on the property. Anomalous gold and silver values are associated with the copper, zinc, and lead values. A HLEM survey located 38 conductors on the property. Several conductors correlate directly with copper–zinc soil anomalies in the north half of the claim group. Five high priority areas have been recommended for detailed evaluation (United Mineral Services Limited, personal communication; Resident Geologist's Files, Timmins, 1988).

Grandad Resources Limited

Early in 1988, Grandad Resources completed a 14–hole, second phase diamond drilling program totalling 1525 m on the Burton Option Property in northeastern Esther Township. Results of the program have not been released. Grandad has returned the property to the vendors (Grandad Resources Limited, M. Burton, personal communication, 1988).

Halex Resources Incorporated

Early in 1988, Halex Resources completed 48.3 line–kilometres of IP surveys on the Heenan Property in Marion, Heenan, and Genoa townships. Halex has the option to earn a 40 percent interest in the 140 claims held by Falconbridge Limited by spending $1 300 000 over three years.

The IP survey outlined numerous drill targets on the property. A six–hole, 730 m diamond drilling program was completed prior to March 1, 1988. A seventh hole was abandoned at 27 m in a siliceous chert unit. Widespread anomalous gold values were reported from the drilling, and two, wide alteration zones were intersected. One alteration zone, in banded iron formation, returned 8.5 m averaging 1.2 g/t gold including 1.3 m averaging 4.9 g/t gold. A second alteration zone was intersected in the felsic metavolcanics underlying the iron formation. This zone averaged 0.83 g/t gold across 12.95 m. Additional work is planned for 1989 (Halex Resources Incorporated, personal communication, 1988).

Halley Resources Limited—Surf Inlet Mines Limited

Halley Resources and Surf Inlet Mines are equal partners on the 22–claim Akweskwa Lake Property in east–central Kenogaming Township. There are two known gold occurrences and two copper–nickel occurrences on the property. Work done by previous claim holders concentrated on the Dunvegan gold–zinc occurrence and on the Jonsmith gold–copper–lead occurrence, which are associated with sericite–pyrite–quartz–carbonate shear zones cutting through the property.

Considerable surface work was done on the property by past claim holders, and several untested exploration targets were identified by Halley Resources personnel. Drill targets included the untested on–strike extensions of the structures hosting the known gold occurrences.

Following reinterpretation of the available data, the partners completed an 11–hole, 1400 m exploratory diamond drilling program on the property. Two holes were put down on the Jonsmith Zone. The mineralized shear was intersected but no significant values were obtained. Nine holes were completed on the Dunvegan Zone located 700 m southwest of the Jonsmith Zone. The best reported intersection was from hole H88–6 which returned 20.5 g/t gold over 1.95 m; visible gold was noted in the intersection. Additional exploration will concentrate on the Dunvegan Zone (Halley Resources Limited, personal communication, 1988; George Cross News Letter, October 20, 1988; Northern Miner Press, October 24, 1988).

Hanson Lake Explorations Limited

Detailed ground geophysics completed early in 1988 confirmed three airborne conductive horizons on the company's 33–claim property in southeastern Rollo Township. One conductive zone correlates well with anomalous gold values in the soils of the area. A three–hole, 370 m diamond drilling program is scheduled for early December (Hanson Lake Explorations Limited, personal communication, 1988).

Hardiman Bay Resources Incorporated

Geological mapping and ground geophysical surveys were completed on the Hardiman Bay Resources 59–claim property in eastern Horwood Township. Several sulphide–mineralized shear zones and quartz–carbonate veins were found on the property. No assay results have been reported. Results of the geophysical surveys have yet to be correlated with geology (Derry, Michener, Booth and Wahl Consultants, personal communication, 1988).

Albert Hopkins (Estate)

A. Hopkins completed a 280 line–kilometre airborne magnetic and VLF–EM survey over a 108–claim block stretched along the northern boundary of Dore and Heenan townships. The property is partially underlain by the same sequence of mafic and komatiitic volcanic rocks hosting Breakwater Resources' Rundle South gold deposit. On Friday, November 11, 1988, Albert Hopkins passed away. His contribution to exploration in the Swayze will be remembered and he will be missed (Resident Geologist's Files, Timmins, 1988; Albert Hopkins, personal communications, 1988; personal observation, 1988).

Isaac Burns Metals Incorporated

Additional stripping and sampling were carried out on the Burns claims in west–central Chester Township. An additional 10 claims have been added to the original three–claim block (Work Report, 1988; D. Constable Consulting Inc., personal communication, 1988).

Jarvis Resources Limited

Jarvis Resources completed a diamond drilling program on the Kaplan Option claims in central Mallard Township. The initial drilling was carried out on the old Ferland–Gauldie–Mogridge gold occurrences. Results from the first five holes returned significant values, including 7.2 g/t gold across 1.8 m, and 6.6 g/t gold across 3.4 m. Gold is associated with pyrite in a silicified mafic tuff. Jarvis Resources has an option to obtain a 60 percent interest in the Kaplan Property by making a series of cash payments and by incurring exploration expenses totalling $500 000 by August 1991. The optioners are entitled to receive a 10 percent net profits royalty (Jarvis Resources Limited, personal communication, 1988; George Cross News Letter, October 27, 1988; Northern Miner Press, November 28, 1988).

Kenty Explorations Limited

Early in 1988, Kenty Explorations Limited completed magnetic and IP surveys over the west half of a 44–claim block in southeastern Rollo Township. Several IP targets were outlined. A 10–hole, 650 m diamond drilling program was started on the east part of the claim block to test previously defined IP targets. The drilling program tested a transitional sequence of intermediate to felsic tuffs, bedded graphitic argillites, and silicic flows and fragmentals enclosed to the north and south by massive and pillowed mafic flows. The anomalies tested were graphitic horizons within the sedimentary sequence. No significant gold values were intersected (Kenty Explorations Limited, personal communication; Resident Geologist's Files, Timmins, 1988).

Marshall Minerals Corporation—Gail Resources Incorporated—Gold Vessel Resources Incorporated

Line cutting and ground geophysical surveys continued through 1988 on the 205–claim Sangold Property in Keith Township. Most of the exploration on the Sangold Property during 1988 was done in an effort to evaluate the Patricia Zone, a gold–bearing, quartz–carbonate vein discovered by stripping in 1987. Channel samples of the vein averaged 5.2 g/t gold across an average width of 1.2 m for 76 m along strike. A drag–folded section of the Patricia vein, the Stockwork Zone, averaged 4 to 8 g/t gold across an average width of 15 m for 35 m along strike.

A seven–hole, 1347 m exploratory diamond drilling program was completed on the property before March 1, 1988. Three holes drilled under the zone returned economically significant gold values. The best intersection averaged 11.0 g/t gold across 0.9 m at a vertical depth of 111.2 m. Four holes were targeted on an IP anomaly that marks the felsic–mafic contact which extends from the Hoodoo and Patricia showings, northwest to the adjoining Joburke Mine Property.

An additional 13 holes totalling 1655.4 m were subsequently completed to further delineate the Patricia Zone. Centred on the initial drill intersection, the drilling tested the zone for 61 m along strike at vertical depths between 50 m and 90 m. Nine of the holes returned significant gold values across variable widths. Some of the more significant intersections reported include 10.25 g/t gold across 11.73 m; 10.6 g/t gold across 16.15 m including 39 g/t gold across 2.4 m; and 3.6 g/t gold across 5.8 m. Geologists for Marshall have indicated the geometry of the mineralized zone is complex and not understood at this time. Displacement of the zone along steep, northeast–trending cross faults was anticipated from surface mapping, but a second set of flat–lying faults found at depth have added to the structural complexity.

An additional 2300 m of drilling is planned and 3050 m will be completed to test the southward continuity of the 16 m intersection grading 10.6 g/t gold, to confirm continuity of the known zone above the 50 m vertical level, and to test for additional gold–bearing zones within the broad deformation zone hosting the Patricia Vein system. Drilling will continue into the new year.

Throughout the summer, extensive stripping, trenching, sampling, and detailed geological mapping were carried out on the southern part of the Sangold Project property. The results of the stripping program have yet to be evaluated (Marshall Minerals Corporation, Gold Vessel Resources Incorporated, personal communication; Northern Miner Press, January 25, February 15, August 29, October 17, 1988; The Daily Press, July 27, 1988; personal observation, 1988).

Noranda Exploration Company, Limited—Anglo Porcupine Gold Mines Limited

Noranda completed ground geophysical surveys on the western part of the Hardiman Bay claim group early in the year. The company holds 136 claims covering the northeast–trending Hardiman Bay Fault in East Horwood Township. Re–evaluation of the stripped areas, where gold values were reported late last year, has begun. The initial program was cut short by the onset of freeze–up. Results of the current program have not been reported. (Noranda Exploration Company, Limited, personal communication, 1988).

Noront Resources Limited—Central Crude Limited

Noront Resources has an option to earn a 50 percent interest in two groups of claims in Benton, Esther, and Osway townships. The two claim groups cover 13 km of the projected northwestward extension of the Jerome Mine structure. Preliminary evaluation of the properties was in progress at the time of writing (Noront Resources Limited, personal communication; Northern Miner Press, October 3, 1988).

Odyssey Explorations Ltd.-Canorth Explorations Ltd.

Odyssey Explorations completed a nine-hole, 629 m diamond drilling program on their 11 patented claims in central Chester Township. Three surface gold showings were tested. Results of the drilling program were not reported (D.R. Bell Geological Services Incorporated for Odyssey Explorations Ltd., personal communication, 1988).

652422 Ontario Incorporated

A three-hole, 283.4 m diamond drilling program was completed on the company's 48-claim property in southeastern Silk Township. Drill targets were VLF-EM anomalies associated with the contact zone between the Whigham granitic batholith and metavolcanics, 2.5 km northwest of the Orofino Resources Limited Swayze Mine property. Two holes intersected massive to weakly foliated granite cut by feldspar-porphyry dikes. The anomalies were attributed to oxidized faults at depth. The third hole, collared 1500 m farther south, intersected massive, pillowed and locally coarse-grained, mafic metavolcanics cut by feldspar-porphyry dikes. No significant mineralization was found. Additional geophysical surveys were completed on the northeastern portion of the claim group (652422 Ontario Incorporated, personal communication; Resident Geologist's Files, Timmins, 1988).

Orofino Resources Limited

A nine-hole, 929.3 m diamond-drilling program was completed on the company's large block of claims in southwestern Horwood Township. The program was designed to test the stratigraphy east of the Swayze Mine deposit in southeastern Silk Township. The area east of the mine site is covered by extensive overburden.

Two short holes were drilled to test the Landry-Taylor showing which is located 400 m south of Stangiff Lake. No significant values were intersected (Orofino Resources Limited, personal communication, 1988).

Patrie Property

Line cutting, ground geophysical surveys, reconnaissance geological mapping, and prospecting were completed over a 45-claim group staked by J. Patrie and D. Patrie in southwestern Denyes Township. The property is just north of the former Lee Lake Gold Mines Limited property.

Initial prospecting revealed numerous, undocumented, overgrown trenches and pits. Quartz veining and (or) sulphide mineralization was present in many of the pits, and significant gold values were noted in two pits located near the centre of the current claim block. Widespread arsenic enrichment was reported, associated with green carbonate-altered and quartz-carbonate veined volcaniclastic rocks near the western boundary of the property.

The No. 1 showing is located in the northwestern corner of claim P.994544. A 0.4 m to 1.2 m wide, northwest-trending quartz vein is partially exposed over 26 m in an old trench. Local concentrations of up to 15 percent pyrite, chalcopyrite, and arsenopyrite were observed within, and adjacent to, the vein. Chip samples taken across the vein ranged from 0 to 17.7 g/t gold across 1.16 m.

The No. 2 showing is 730 m southeast of, and along trend from, the No. 1 showing. Two quartz veins, trending 140° to 150°, were exposed intermittently in a series of old trenches. The host rocks are highly sheared and deformed, carbonatized mafic metavolcanics. A fault scarp trending 130° to 150° is partially exposed at the southwestern end of the main trenched area. The vein zone is 8 m wide and was exposed over a 30 m strike length.

The veins are variably mineralized with pyrite, chalcopyrite, galena, and trace amounts of arsenopyrite. Values from chip samples across the southernmost vein exposure ranged from 1.5 g/t gold across 1.16 m to 3.25 g/t gold across 0.76 m. Chip samples taken from the north vein ranged from trace to 17.6 g/t gold across 0.41 m (J. Patrie, personal communication, 1988; personal observation, 1988).

Placer Dome Incorporated—Algoma-Talisman Minerals Limited

Early in 1988, Placer Dome completed a 22-hole, 3558 m diamond drilling program on their 65 km^2 patented property in Newton and Coppell townships. Drill targets included the "West Extension" Zone which was tested previously, an area where a large mineralized boulder reportedly returned 10 g/t gold across 3.3 m, and several geophysically defined targets were outlined in 1987. The results of the drilling program have not been reported.

During the summer field season, 50 line-kilometres of geological mapping and geochemical surveys were completed. Limited stripping and trenching were also carried out on the property.

Algoma-Talisman Minerals retains a 20 percent interest in the Newton Township property (Placer Dome Incorporated, personal communication, 1988; Northern Miner Press, February 8, 1988).

Quinterra Resources Incorporated

Early in 1988, Quinterra Resources completed a 13-hole, 1974 m diamond drilling program on a large block of claims in Tooms, Greenlaw, and Halcrow townships. The drilling program was a follow-up to 1987 drilling in which significant gold values over narrow widths in two drillholes 2000 m apart were reported. Most of the drilling took place south of Betty Lake in Tooms Township near the 1987 hole, SC-87-4. Quinterra reported values of

4.28 g/t gold over 2.65 m, 4.9 g/t gold over 0.7 m and 2.9 g/t gold over 1.83 m from three separate horizons intersected in this hole. No significant intersections were reported from the follow–up drilling.

One hole was drilled beside 1987 hole SC–87–5 (which was collared into a mineralized feldspar–quartz porphyry that returned 3.55 g/t gold over the first 1.37 m). This unit was not encountered in the follow–up hole (Quinterra Resources Incorporated, personal communication, 1988; Resident Geologist's Files, Timmins).

Raney Minerals Limited

Raney Minerals carried out a 13–hole, 365 m diamond drilling program on the 72–claim J–Dex Property in south–central Raney Township. A Winkie drill was used to test several surface showings and geophysical targets near surface gold showings. Many of the holes failed to reach their targets and the program was stopped. In the core, several altered quartz–feldspar porphyritic units were observed within a sequence of ash and lapilli tuffs, dolomitic carbonate schists, and argillites. Extensive sericite–carbonate–quartz shear zones were also reported. No significant intersections have been reported. Diamond drilling, using a larger machine, is planned for 1989 (Raney Minerals Limited, personal communication, 1988).

Steetley Industries Limited

A three–hole, 378.3 m surface exploratory diamond drilling program was completed on a portion of Steetley's leased claims in north–central Penhorwood Township. One hole was drilled to test the Bromley–Lafortune arsenopyrite–gold occurrence. The other two holes tested IP anomalies located on other parts of the property (Steetley Industries Limited, personal communication, 1988).

Tonopah Resources Incorporated—Telstar Resources Limited

Tonopah Resources and Telstar Resources are joint venture partners on a 35–claim property in southwestern Huffman Township. Telstar Resources can earn a 50 percent interest in the property by spending $1 000 000 on exploration and by making a cash payment of $100 000 over ten years.

Early in 1988, Tonopah completed a four–hole, 455.4 m diamond–drilling program on the central part of the property. Drill targets were isolated HLEM conductors located just north of a prominent northwest–trending banded iron formation in the southern part of the property. Results of this drilling indicated that the conductors were graphitic argillaceous sediments, and pyrite–pyrrhotite mineralized pyroclastics associated with an interflow sedimentary sequence within foliated mafic flows. Minor chalcopyrite was noted in some holes. No assay results have been released (Tonapah Resources Incorporated, personal communication, 1988; George Cross News Letter, March 22, 1988; Resident Geologist's Files, Timmins).

Other Exploration Activity

Ground geophysics was carried out on the nine–claim David Jones Property in northeastern Cunningham Township (Resident Geologist's Files, Timmins, 1988).

Line cutting and ground geophysics were carried out on a portion of Murgold Resources Incorporated's 231–claim property in Chester and Benneweis townships. The claim group is outside of the 70–claim property controlled jointly by Murgold Resources and Chester Resources Incorporated (Murgold Resources Incorporated, personal communication, 1988).

Ground geophysical surveys were completed on Plum Resources' 12–claim property in northeastern Horwood Township (Resident Geologist's Files, Timmins, 1988).

The Seaway Base Metals 41–claim property in northern Chester Township was covered by a 135 line–kilometre airborne geophysical survey in 1988 (Resident Geologist's Files, Timmins, 1988).

Swayze Resources completed a ground magnetic survey over two claims in northeastern Swayze Township (Resident Geologist's Files, Timmins, 1988).

RESIDENT GEOLOGISTS' STAFF ACTIVITIES

Staff of the Resident Geologist's Office in 1988 included: L.E. Luhta, Resident Geologist; P.J. Sangster, Staff Geologist; D.M. Draper, Data Geologist; C.D. Hamblin, Drill Core Library Geologist; M.L. Leroux, Drill Core Library Assistant and D.C. Egerland, Secretary.

Temporary staff hired under Experience '88 and the Canada–Ontario Unemployment Insurance Section 38 Job Creation Program included: R. Gauthier, L. Drouin, L. Gombik, C. Bond, D. Leroux, and S. Rogers–Crick.

M.P. Bradshaw, who continued to work as a Staff Geologist on a contract basis, was seconded for the summer field season to the Ontario Geological Survey, Project 88–37, Paleozoic Geology of the Gypsum Deposits of the James Bay Lowland.

J.C. Ireland continued on a contract basis as Staff Geologist responsible for the Swayze area. During 1988, 29 field visits were made to 18 properties throughout the Swayze area. Periodic visits were made to on–going, advanced exploration projects. Seven field tours were conducted for the benefit of industry and government personnel and agencies.

Work is progressing on an updated summary of the exploration activity in 10 townships in the south-central Swayze area. This report will be a continuation of the compilation done by Siragusa (1987). The new summary will include Osway and Huffman townships, which were previously mapped by Siragusa (1980a, 1980b). A geological compilation map with detailed interpretations of property-scale mapping provided by the mining industry, will accompany the report.

During 1988, there were 12 producing gold mines, including two leaching programs, one base-metal mine, and two producing industrial minerals deposits. There are, in addition, over 20 gold projects in the advanced evaluation and development stage. Staff of the Timmins Resident Geologist's Office, during the course of the year, made property visits to all of the producing mines and development projects, and the majority of the exploration projects mentioned in detail in this report.

Using staff provided under the Canada-Ontario Unemployment Insurance Section 38 Job Creation Program, a detailed search was made of microfilm copies of the Northern Miner for articles relevant to the Porcupine Camp.

This summer proved to be a banner year for field trips in the Porcupine Camp. From June to October, over 20 field trips were given to a variety of groups including local high school and college students, visiting dignitaries, and geologists from Canada, Brazil, China, Finland, the United States, Australia, Germany, and the Soviet Union. In addition, over 2500 office consultations were recorded.

The Resident Geologist's Office once again presented a regional Geoscience Seminar in February, combining the most regionally significant aspects of the Ontario Mines and Minerals Symposium, with presentations by regional staff and industry representatives. A photographic inventory of mines and development projects was completed and presented during the seminar.

The staff of the Resident Geologist's Office was responsible for the revitalization of the Porcupine Geological Discussion Group which had been inactive for the previous two years. Regular discussions have been presented since April 1988.

During 1988, compilation of eight Geological Data Inventory Folios (GDIFs) for the Swayze area was completed; three others are nearing completion, and a further 25 are in progress.

A total of 287 assessment and 44 Ontario Mineral Exploration Program submissions were received and processed into the Timmins Resident Geologist's files. Also completed in the past year was a project to correlate and cross-reference drilling data available at the Timmins Drill Core Library with the office assessment files.

DRILL CORE LIBRARY PROGRAM

During the past year, representatives of industry and government made 493 visits to the Timmins Drill Core Library facilities. A total of 26 252 m of drill core was collected. The core library is now storing 123 798 m of drill core, representing some 481 368 m of drilling. During 1988, drill core was received from the following sources:

B. Ellies Property, Tisdale Township

Balmoral Porcupine Mines Limited, Adams Township

BHP-Utah Mines Limited, Swayze Township

BP Resources Canada Limited, Keith and Muskego townships

Canorth Resources Limited, Chester Township

Cominco Limited, Carscallen Township

Davidson Tisdale Mines-Getty Resources Limited, Tisdale Township

FinNeth Exploration Limited, Carscallen Township

Geological Survey of Canada, 15 townships

Highwood Resources Limited, Bristol Township

Peter Island Resources Incorporated, Tisdale Township

R. MacGregor Property, Cunningham Township

Syngold Exploration Incorporated, Tisdale and Whitney townships

Unigold Resources Limited, Keith Township

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

A detailed description of work done by the Ontario Geological Survey in the Timmins Resident Geologist's District is provided in the 1988 Summary of Field Work (Ontario Geological Survey 1988). Several of these projects were funded by the five year Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

Project 87-15: Geology of Tisdale and Northern Whitney Townships.

D.W. Piroshco and K. Kettles completed the second and final year of mapping Tisdale and Whitney townships. The stated object of the project was to update the geological data base for the two townships, to provide a framework for future exploration, and to outline areas for further study. The project was part of the COMDA agreement.

Project 88-06: Geological Setting of Gold Mineralization in the Southern Swayze Belt.

G.M. Siragusa studied three gold occurrences in Esther, Osway, and Chester townships in order to document lithological, structural, and alteration characteristics to aid in the exploration for such deposits in the Swayze Belt. The occurrences studied were: the A. Burton Occurrence in Esther Township, the Jerome Mine in Osway Township, and the Chesbar Resources–Murgold Resources joint venture property in Chester Township.

Project 88–37: Paleozoic Geology of the Gypsum Deposits in the James Bay Lowland.

R.K. Bezys and M.P. Bradshaw completed detailed mapping of the Moose River Formation to delineate the distribution of its gypsiferous horizons. The object of the study was to obtain detailed geological information on, and a resource map of, the James Bay Lowland gypsum deposits. The program was funded under COMDA.

Project 88–26: Recent Airborne Electromagnetic–Magnetic Surveys in Northern Ontario.

The field survey portion of an airborne survey covering the Detour–Burntbush–Abitibi area was completed during 1988 and results will be released in the spring of 1989.

In March of 1988, results of the 1987 airborne survey covering a 64–township area, centred on the city of Timmins, were released. These projects are part of the five year 1987 Airborne Geophysical Survey Program for Northern Ontario and are funded by the Northern Ontario Regional Economic Development Program (NOR–DEV).

Project 86–20: Quaternary Geology of the Shining Tree Area.

P.W. Alcock completed Quaternary mapping of the map area at a scale of 1:50 000, including reconnaissance surficial till sampling and overburden trenching. Airphoto interpretation, map compilation, and analysis of data are currently in progress.

The Sudbury Resource Technology Centre, supported by the Ontario Ministry of Northern Development and Mines, in conjunction with the Canadian Centre for Mineral and Energy Technology (CANMET) and the Mineral Processors Division of the Canadian Institute of Mining and Metallurgy, presented a three–day technical symposium on the heap leaching of gold. The symposium was held in Timmins at the end of May 1988.

In January 1988, Peter Telford and Geoff Minnes of the Industrial Minerals Section of the Minerals Development and Land Branch of the Ministry of Northern Development and Mines presented a seminar on the economic viability of the Cargill phosphate deposit. The results of a study done by Blue Johnson of California were summarized. Versions of the seminar were also given in Toronto and Kapuskasing.

RESEARCH BY OTHER AGENCIES

MINERAL DEVELOPMENT AND LANDS BRANCH

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

Grant recipients with projects directly related to the Timmins Resident Geologist's District during 1987 and 1988 are listed below:

Grant 298 The Geological Setting of Gold Deposits in the Porcupine Mining Camp, by R. Mason, D.I. Brisbin, and S. Aitken, Department of Geological Sciences, Queen's University, Kingston.

Grant 280 Lead Isotope Study of Gold Mineralization in the Dome Mine Quartz Fuchsite Vein, by R.P. Moritz, J.H. Crocket, and A.P. Dickin, Department of Geology, McMaster University, Hamilton.

GEOLOGICAL SURVEY OF CANADA

During the summer of 1988, the Geological Survey of Canada completed its second year of reconnaissance overburden drilling in the North Clay Belt. A total of 44 holes were drilled between Timmins and Smokey Falls, bringing the two year total to 70.

A comprehensive study of granule–pebble–fraction lithology, heavy minerals, and geochemistry, along with development of depositional models, will allow preliminary correlations to be better defined. It is hoped that solving this problem will enhance the usefulness of drift prospecting in the Timmins area (Geological Survey of Canada, personal communications, 1988).

SELECTED PUBLICATIONS RECEIVED, 1988

Bezys, R.K.A.

1987: An Ichnological and Sedimentological Study of Devonian Black Shales from the Long Rapids Formation, Moose River Basin, Northern Ontario; Unpublished MSc Thesis, McMaster University, Hamilton, 244p.

Bolton, T.E.

1987: Geoscience Council: Current Research in the Geological Sciences in Canada, May 1986–April 1987; Geological Survey of Canada Paper 87–5, 113p.

Brehaut, C.H., and Hedley, D.G.F.

1988: 1986–1987 Annual Report of the Canada–Ontario–Industry Rockburst Project; CANMET Special Report SP87–7E, 22p.

Burlington, J.L.

1985: The Geology and Geochemistry of the Aquarius Deposit, Timmins, Ontario, Canada; Unpublished MSc Thesis, University of Western Ontario, London, 161p.

TABLE 12.4. MAPS AND REPORTS PERTAINING TO THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT, ISSUED BY THE ONTARIO GEOLOGICAL SURVEY IN 1988.

Open File Reports

OFR 5681	The Platinum Group of Elements in Ontario
OFR 5688	Ontario Geoscience Research Grant Program, Grant No. 192, Geochemical Exploration for Gold

Miscellaneous Papers

MP 138	Report of Activities 1987, Resident Geologists
MP 139	Archean Lode Gold Deposits in Ontario: Part I. A Depositional Model; Part II. A Genetic Model
MP 141	Summary of Field Work and Other Activities, 1988

Studies

Study 32	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Lackner Lake Alkalic Rock Complex

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IMBP 8	Fine China, Trials with Ontario Minerals
IMBP 9	Advanced Ceramics: Impact on Ontario Industry

Geological Data Inventory Folios

GDIF 403	Stock Township

Airborne Electromagnetic and Magnetic Survey

Maps 81035 to 81098	Timmins Area, District of Cochrane

Geophysical/Geochemical Series Maps

Map 81126	Sonic Drillholes 87-57, 87-58, and 87-60, Bond Township
Map 81127	Sonic Drillhole 87-59, Bond Township
Map 81128	Sonic Drillhole 87-61, Sheraton Township
Map 81129	Sonic Drillholes 87-62 and 87-63, Sheraton and Thomas Townships

Preliminary Maps

P.3130	Gold Grains in Sonic Drill Core Samples (1988) from the Lake Abitibi-Matheson Area

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13. Kirkland Lake Resident Geologist's District—1988

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INTRODUCTION

The Kirkland Lake Resident Geologist's District comprises about the northern two-thirds of the Larder Lake Mining Division. As of February 1987, this district no longer corresponds exactly with the Mining Division.

The Larder Lake Mining Division remained active again this year with 26 240 active claims, although the number of new claims recorded are lower than in previous years. Assessment work filed also remained at the highest levels recorded in the division (Table 13.1).

The official opening at American Barrick Resources Corporation's Holt–McDermott Mine on August 9th marked the first major new gold mine to begin operation in the Kirkland Lake area in more than 50 years.

Canada's first gold tailings retreatment mill officially opened on June 1st by Eastmaque Gold Mines Limited. A flotation concentrate is produced which is then shipped to Noranda, Quebec, for further refining.

In September, Lac Minerals began operating its new mill at the Macassa Mine. Capacity of the new mill is 500 tons of ore per day from the Macassa Mine and 750 tons of tailings per day from Kirkland Lake.

When the federal government decided to phase out flow through share financing, a group of concerned citizens in Kirkland Lake organized a National Save the Flow Through Committee which resulted in the implementation of the Canadian Explo-

TABLE 13.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	3,885	4,814	26,240	209,276	333,274	34,998	654,132
1987	6,742	3,854	27,146	197,727	319,836	17,872	600,241
1986	6,973	6,787	24,160	107,108	399,511	48,263	631,038
1985	7,558	5,011	23,974	95,076	276,646	19,517	460,183
1984	7,943	4,492	21,397	93,946	245,542	44,113	473,820
1983	8,354	3,866	17,946	121,213	98,366	15,233	304,770
1982	3,253	5,218	13,458	99,526	133,511	17,926	313,690
1981	5,498	2,697	15,423	69,906	125,459	19,536	247,087
1980	6,299	1,834	12,622	64,454	115,031	10,981	209,357
1979	4,261	1,452	8,157	29,714	25,352	4,990	68,763
1978	1,710	2,065	5,248	32,602	38,100	8,887	87,144
1977	1,826	2,334	5,703	37,101	45,436	1,820	98,992
1976	2,350	2,979	6,712	47,724	42,338	6,220	102,936
1975	2,916	5,010	7,341	45,880	38,047	6,738	98,624
1974	4,757	2,296	9,435	40,678	55,716	4,441	110,165
1973	3,260	3,214	6,974	34,113	35,811	8,150	92,616
1972	3,253	4,740	6,781	39,371	52,351	3,358	106,026
1971	4,065	3,846	8,268	29,433	48,785	4,764	96,047
1970	4,315	3,704	8,049	25,683	28,683	4,133	73,157
1969	3,404	5,273	7,438	50,892	45,713	15,829	130,185
1968	4,171	7,909	9,307	74,649	82,637	5,799	180,437
1967	5,450	7,341	13,045	79,172	29,073	4,032	143,600
1966	7,606	11,101	14,936	117,544	30,971	8,050	182,352
1965	9,331	6,906	18,431	123,129	88,259	6,530	257,029
1964	12,842	3,884	22,912	77,807	32,644	11,725	149,198
1963	4,710	3,895	13,954	95,696	16,241	4,226	138,627
1962	4,675	4,028	13,139	63,003	5,494	5,099	97,219
1961	3,749	4,451	12,492	47,862	5,494	1,118	79,219
1960	5,024	6,747	13,194	75,123	7,296	4,751	104,632
1959	6,419	5,594	14,917	22,947	3,792	1,404	80,322
1958	8,582	7,108	14,902	37,381	7,481	1,941	66,783
1957	4,664	8,212	12,618	95,934	12,593	3,948	139,891
1956	9,673	3,594	16,166	77,879	20,982	6,693	130,894
1955	4,182	3,999	10,087	75,561	3,389	3,529	105,925

ration Incentive Program (CEIP) with the Ontario office located in Kirkland Lake.

MINING ACTIVITY

There were ten producers in the Kirkland Lake Resident Geologist's District (Figure 13.1) during 1988: seven gold mines, one iron mine, one barite mine, and a serpentine filler mine.

American Barrick Resources Corporation

On August 9, 1988, American Barrick officially opened its Holt–McDermott Mine in northwestern Holloway Township. Capital costs to bring the mine and 1500 ton per day milling complex into production, are reported to have been $78 million and, when fully operational, anticipated costs to produce one ounce of gold are estimated to be $225 (Kirkland Lake Northern Daily News, August 9, 1988). Commercial production from the Holt–McDermott Mine began on July 1, 1988, and annual production is anticipated to be at a rate of about 80 000 ounces of gold per year commencing in 1989. Proven and probable reserves at the mine are 4 million tons averaging 0.152 ounce gold per ton. American Barrick anticipates producing about 30 000 ounces of gold during 1988 (The Financial Post, August 9, 1988). In early August, the mine consisted of a 3–compartment, 420 m deep vertical shaft with development drifts established on the 100, 150, 200, 250, 300, and 350 m levels. According to J. Boutin (Chief Mine Geologist, Holt–McDermott Mine, personal communication, December 6, 1988), development at the mine during 1988 up to the end of November, was 5080 m of drifting, 1179 m of raising, 714 m of subdrifting between lev-

TABLE 13.2. PAST GOLD PRODUCTION IN THE KIRKLAND LAKE RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1987).

Mine	Township	Tons Milled	Production		Grade	Yrs. of
			(oz. Au)	(oz. Ag)	(oz Au/T)	Production
Aljo	Beatty	2,333	42	5	0.02	1940
American Eagle	Munro	60	40	nil	0.67	1911
Argyll	Beatty	25	30	nil	1.20	1918
Ashley	Bannockburn	157,076	50,123	7,644	0.32	1932-1936
Baldwin	Eby	81	43	81	0.53	1929,1938
Barry Hollinger	Pacaud	267,741	77,000	8,502	0.26	1918,25-36,44-46
Bidgood	Lebel	586,367	160,184	72,468	0.27	1934-51
Blue Quartz	Beatty	500	81	33	0.16	1923,26,28,34
Bourkes	Benoit	1,298	277	50	0.21	1918,36-38
Canadian Arrow	Hislop	279,593	17,045	nil	0.06	1980-1983
*Cathroy Larder/Mirado Mine	McElroy	89,719	10,231	993	0.11	1941-44,47,57,87
**Centre Hill	Munro	327,007	422	36,883	.001	1967-1970
Chesterville	McGarry	3,260,439	358,880	19,371	0.11	1930-1952
Croesus	Munro	5,333	14,859	1,423	2.79	1915-18,23,31-36
Gateford (Swastika)	Teck	103,684	30,068	nil	0.29	1910-1947***
Golden Summit	Maisonville	737	57	nil	0.08	1936-37,45
Gold Hill	Catharine	4,616	660	nil	0.14	1927-28
Gold Pyramid	Guibord	175	36	nil	0.21	1911
Hudson-Rand	Teck	6,496	483	143	0.07	1922
*Kerr Addison	McGarry	38,316,564	10,261,902	570,525	0.27	1911,1938-
Kerr Addison (Murphy)	Garrison	70,000	9,000	nil	0.12	1981
Kirkland Lake	Teck	3,140,283	1,172,955	130,579	0.37	1916-1960
Kirkland Townsite	Teck	4,230	1,921	168	0.45	1958-1959
Laguerre	McVittie	40,514	7,568	1,383	0.19	1937-1939
*Lake Shore	Teck	17,117,923	8,573,246	1,955,132	0.50	1918-65,1982-87
*Macassa	Teck	6,305,835	2,768,097	425,417	0.44	1933-
Matachewan Consolidated	Powell	3,525,200	378,101	133,210	0.11	1934-1954
Miller Independence	Pacaud	31	59	70	1.90	1918
Moffat-Hall	Lebel	16,388	4,780	1,149	0.29	1934-1935
Morris Kirkland	Lebel	127,253	16,999	29,754	0.13	1936-38,40-42
New Telluride	Skead	104	62	50	0.60	1931-1932
Omega	McVittie	1,615,081	214,098	29,290	0.13	1913,26-28,36-47
Queenston	Gauthier	1,054	177	2,380	0.17	1941
Queenston-INCO (McBean-1987)	Gauthier	557,621	45,900	nil	0.08	1984-1986
*Ross	Hislop	6,477,779	974,283	1,544,795	0.15	1936-
**Ryan Lake	Powell	184,790	1,352	36,141	0.01	1948-57,62-64
Stairs	Midlothian	15,835	3,573	1,767	0.23	1965-1966
Sylvanite	Teck	5,049,536	1,674,808	337,956	0.33	1927-1961
Teck Hughes	Teck	9,565,302	3,709,007	501,657	0.38	1917-1968
Toburn	Teck	1,186,316	570,659	135,238	0.48	1912-1953***
Upper Beaver	Gauthier	580,562	140,709	59,167	0.24	1913-1972***
Upper Canada	Gauthier	4,648,984	1,398,291	589,696	0.30	1938-1971
White-Guyatt	Munro	50	10	nil	0.20	1911
Wright Hargreaves	Teck	9,934,327	4,821,296	853,643	0.49	1921-1965
Young-Davidson	Powell	6,213,272	585,690	131,939	0.10	1934-1957
Total		119,617,474	38,004,084	7,526,284	0.32	

*Producer in 1987
**Base Metal Mine
***Intermittent Production

els, 63 262 m of underground drilling, and 1760 m of surface diamond drilling. Through the end of September 1988, 105 696 t of ore grading 3.5 g/t were hoisted and 11 859 ounces of gold were recovered. Silver is also recovered at an approximate gold to silver ratio of 10:1. A minor amount of copper is also recovered.

Canamax Resources Inc.

Canamax Resources reached an agreement in principle with American Barrick, whereby American Barrick will purchase six claims in Holloway Township which contain the Mattawasaga gold deposit (Canamax Resources Inc., Press Release, September 13, 1988). The Mattawasaga deposit contains drill–indicated reserves of 1.7 million tons averaging 0.12 ounce gold per ton (R. Roussain, Assistant Manager of Exploration, Canamax Resources Inc., Timmins Office, written communication, November, 1988). The Mattawasaga deposit is located about 1300 m east of the Holt–McDermott Mine.

Canamax Resources continued surface exploration and underground exploration programs, development, and mining at the East Zone gold deposit in northern Holloway Township, where 493 035 tons of material averaging 0.216 ounce gold per ton have been delineated in two zones (Canamax Resources Inc., 1987 Annual Report). During the year, Canamax began shipping ore from the East Zone to Cambior Inc.'s Vezina Mine mill in Destor, Quebec, and anticipates producing about 8000 ounces of gold from the property in 1988 and about 21 000 ounces of gold during 1989 (Canamax Resources Inc., 1987 Annual Report).

Dofasco Inc.

The Adams Mine, which is owned by Dofasco and operated by Cliffs of Canada Ltd., celebrated a milestone in its 24–year history on April 29, 1988, when total production of iron ore reached 25 million tons (Northern Daily News, May 2, 1988).

Extender Minerals of Canada Ltd.

Extender Minerals produced barite from their mine and mill in Yarrow Township and at the former Ryan Lake Mine near Matachewan, respectively.

Eastmaque Gold Mines Limited

The Eastmaque Gold Mines' tailings recovery operation officially opened June 1, 1988. Dredging operations are designed at a pumping rate of 2250 tons of tailings per day (The Northern Miner, December 28, 1987). Recoverable reserves are anticipated to be 6 700 000 tons of tailings grading 0.041 ounce gold per ton. A current drilling program is expected to add 3 million tons of recoverable reserves (George Cross News Letter, September 27, 1988).

Giant Yellowknife Mines Limited

Giant Yellowknife Mines continued to produce gold, silver, and copper from its Ross Mine in Hislop Township. The Ross Mine has been in continuous production since 1936. Since the inception of mining operations, more than 6.78 million tons of ore has been milled, producing more than 983 000 ounces of gold (at an average recovery grade of 0.145 ounce gold per ton), more than 1.64 million ounces of silver (at an average recovery grade of 0.242 ounce silver per ton), and more than 2760 tons of copper (at an average recovery grade of 0.156 percent copper). This year, until October 31, 1988, Giant Yellowknife completed 30 419 feet of drilling for blasting, 10 621 feet of long–hole diamond drilling, 967.6 feet of stope preparation, and 12 019 feet of underground definition and exploration diamond drilling. During this time, 90 414 tons of ore were broken, 190 412 tons of ore were pulled, 193 971 tons of ore were hoisted, and 191 412 tons of ore averaging 0.144 ounce gold per ton were milled (R. Powers, Chief Mine Planner, Ross Mine, Giant Yellowknife Mines Limited, written communication, December 1988).

Golden Shield Resources Ltd.

The Kerr Mine, operated by Golden Shield Resources, celebrated its 50th anniversary on June 24 and 25, 1988 (Northern Daily News, June 10, 1988). Reserves at the mine stand at 1 million tons grading 0.12 ounce gold per ton. At the Barber Larder Mine, open pit mining operations were completed; ore from the pit is milled at the Kerr Mine.

Hedman Resources Ltd.

Hedman Resources continued to produce Hedmanite–lizardite mineral filler from its open pit mine in southern Warden Township and its milling plant in Matheson. Production for the fiscal year (ending July 31, 1988) amounted to total revenues of $877 000; 63 percent of the product was exported. The main markets for Hedmanite are currently plastics, friction materials, and building products (J.J. Mangan, Chairman, Hedman Resources Ltd., written communication, November 23, 1988).

Lac Minerals Ltd.

Lac Minerals offically opened their new mill at the Macassa Mine on September 20, 1988. The mill has a combined capacity of 1250 tons of ore and tailings per day; 500 tons of ore from the Macassa Mine, and 750 tons of tailings from Kirkland Lake. The mill has been in operation since mid–July and uses the carbon–in–pulp extraction method. The old mill, in operation since 1937, will be kept on stand–by for possible custom milling.

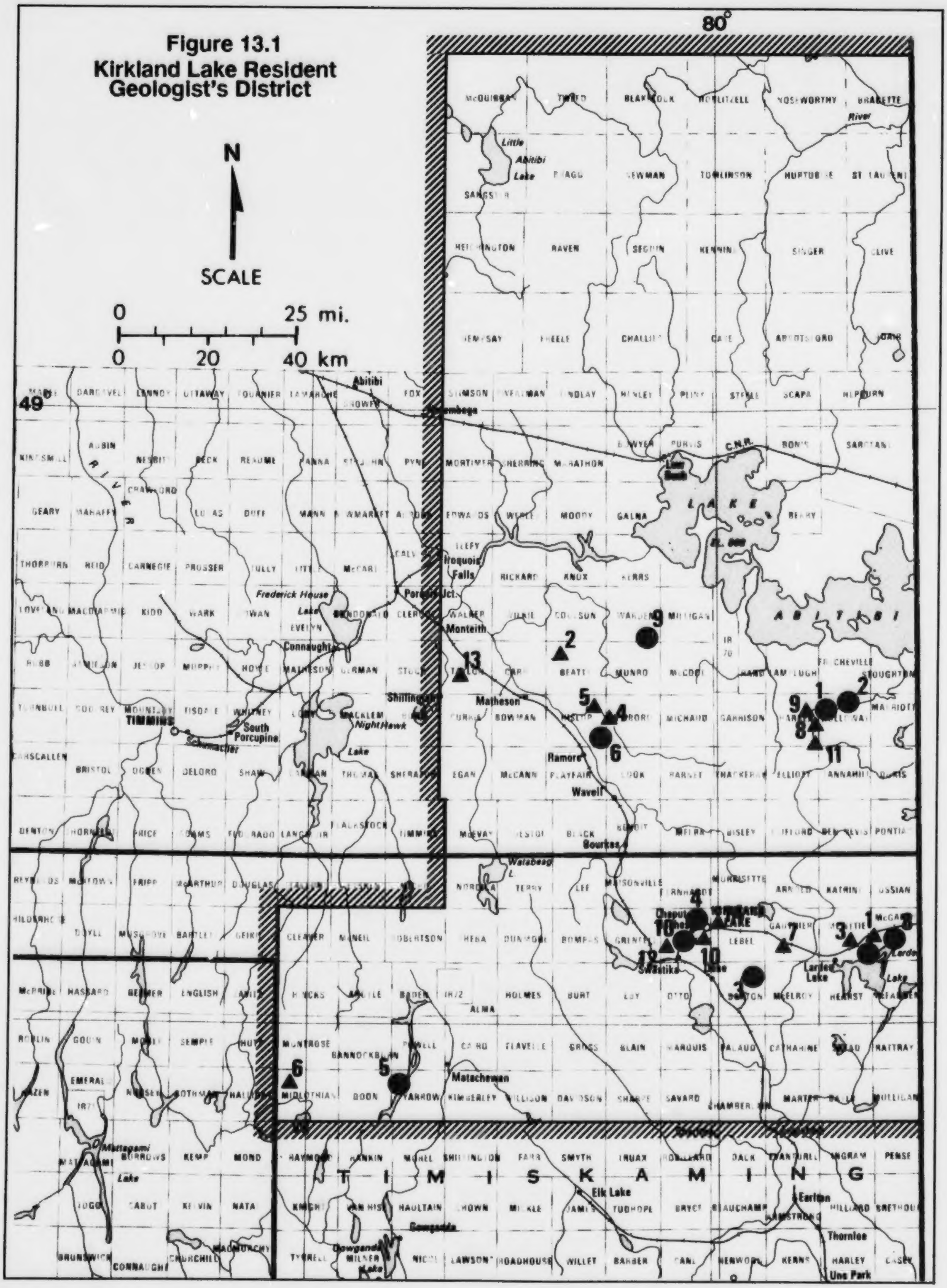

Figure 13.1
Kirkland Lake Resident Geologist's District

N
SCALE
0
25 mi.
0
20
40 km
80°
49°
Timmins
South Porcupine
Schumacher
Night Hawk Lake
Frederick House Lake
Connaught
Porquis Jct.
Iroquois Falls
Monteith
Matheson
Shillington
Ramore
Wavell
Bourkes
Abitibi
Little Abitibi Lake
Lake Abitibi
C.N.R.
Watabeag L.
Swastika
Larder Lake
Matachewan
Elk Lake
Gowganda
Gowganda Lake
Mattagami Lake
Earlton
Thornloe
Uno Park
River
T I M I S K A M I N G
1
2
3
4
5
6
7
8
9
10
11
12
13

EXPLANATION

▨ District Boundary

● Producing Mines

1. American Barrick Resources Corp.
   Holt–McDermott Mine .... Au, Ag, Cu
2. Canamax Resources Inc.
   Matheson Project .... Au
3. Dofasco Inc. – Cliffs of Canada Ltd.
   Adams Mine .... Fe
4. Eastmaque Gold Mines Ltd.
   Kirkland Lake Tailings Project .... Au
5. Extender Minerals of Canada Ltd. .... Barite
6. Giant Yellowknife Mines Ltd.
   Ross Mine .... Au, Ag, Cu
7. Golden Shield Resources Ltd.
   Barber Larder Mine .... Au
8. Golden Shield Resources Ltd.
   Kerr Mine .... Au, Ag
9. Hedman Resources Ltd. .... Serpentine Filler
10. Lac Minerals Ltd.
   Macassa Mine .... Au, Ag

▲ Properties Under Evaluation

1. Armistice Resources Ltd.
   Sheldon – Larder Property .... Au
2. Equinox Resources Ltd. – Technigen Corp.
   Maude Lake Gold Mine .... Au
3. Golden Shield Resources Ltd.
   Cheminis Mine .... Au
4. Goldpost Resources Inc.
   Hislop East Property .... Au
5. Goldpost Resources Inc.
   Hislop West Property .... Au
6. Goldteck Mines Ltd.
   Stairs Mine .... Au
7. Inco Gold Co. – Queenston Gold Mines Ltd.
   Anoki Property .... Au
8. Lenora Explorations Ltd.
   Golden Harker Property .... Au
9. Lenora Explorations Ltd. – American Barrick Resources Corp.
   Three Star and Worvest Properties .... Au
10. Newfields Minerals Inc.
   Teck–Hughes Property .... Au
11. Perrex Resources Inc. – The Alberta Gold Exploration Corp.
   Iris Property .... Au, W
12. Queenston Gold Mines Ltd. – Lac Minerals Ltd.
   Kirkland West Property .... Au
13. St. Andrew Goldfields Ltd.
   Porphyry Zone .... Au
14. Toburn Gold Mines Ltd.
   Toburn Mine .... Au

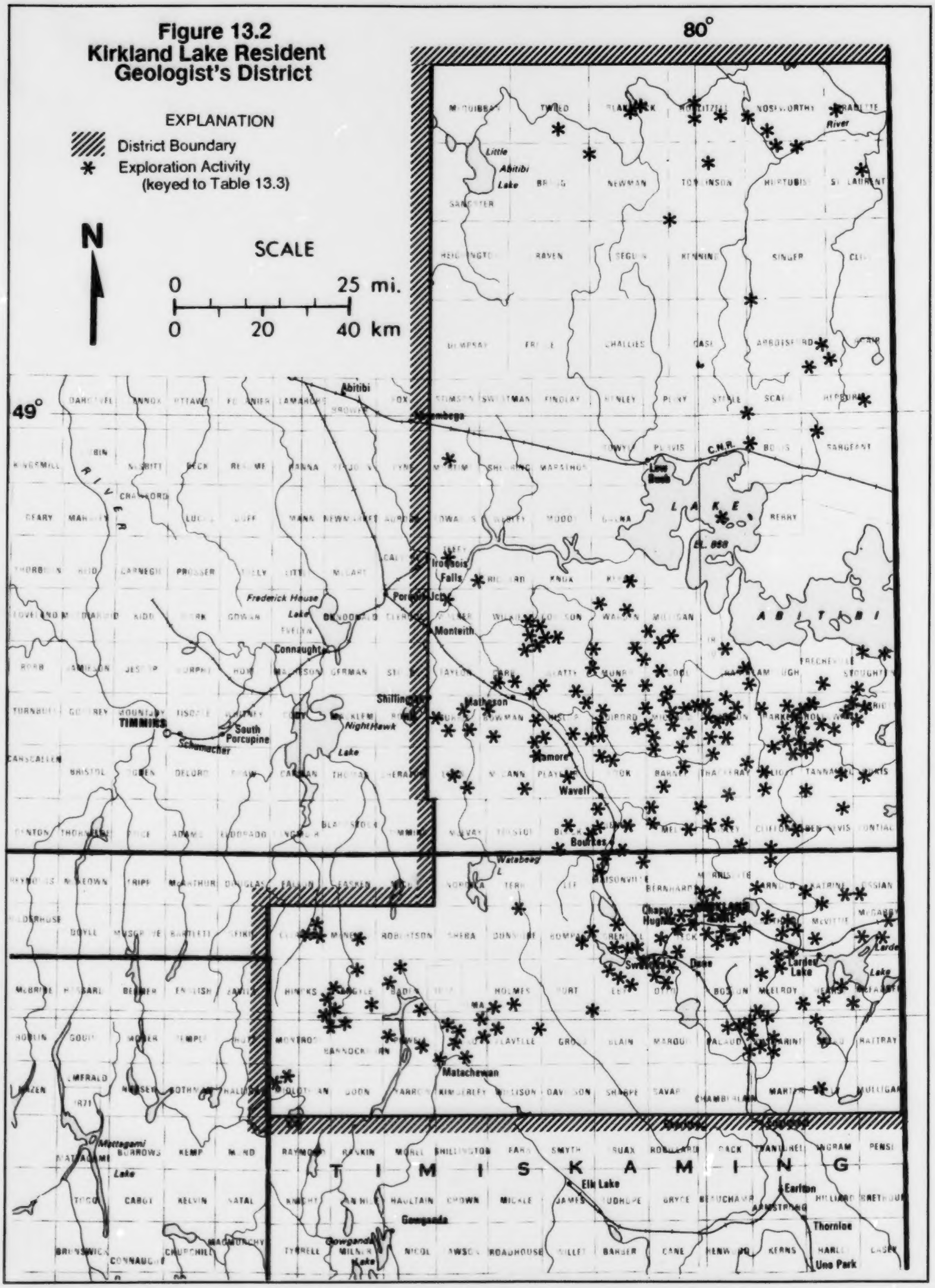

Figure 13.2 Kirkland Lake Resident Geologist's District

EXPLANATION
District Boundary
Exploration Activity (keyed to Table 13.3)
N
SCALE
0
25 mi.
0
20
40 km
80°
49°
Little Abitibi Lake
River
Abitibi
Nemembega
C.N.R.
Low Bush
LAKE
EL 858
ABITIBI
RIVER
Iroquois Falls
Porquis Jct.
Monteith
Frederick House Lake
Connaught
Shillington
Matheson
TIMMINS
South Porcupine
Schumacher
Night Hawk Lake
Ramore
Wavell
Bourkes
Watabeag L.
Chaput Hughes
KIRKLAND LAKE
Swastika
Dane
Larder Lake
Matachewan
Mattagami Lake
TIMISKAMING
Elk Lake
Gowganda
Gowganda Lake
Earlton
Thornloe
Uno Park

TABLE 13.3. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company		Activity
1	Accord Resources Inc.	Stoughton	Diamond Drilling (526')
2	Accord Resources Inc.	Lebel	Stripping
3	Actuate Resources Inc.	Alma	Magnetic Survey
4	Alberta Gold Expl. Corp.	Harker	Diamond Drilling (571'), Stripping
5	Allsopp, A.	Otto	Diamond Drilling (153'), Stripping, Trenching
6	American Barrick Res.	Harker,Holloway	Diamond Drilling (33,606'), Geology Report
7	Anderson,A.	Eby	Stripping
8	Anderson,A.	Hislop	Magnetic Survey, Electromagnetic Survey
9	Annett,R.	Catharine	Stripping, Sampling
10	Armistice Resources Ltd.	McGarry	Diamond Drilling (9,547')
11	Asarco Expl. Can. Ltd.	Beatty	Overburden Drilling (778')
12	Asarco Expl. Can. Ltd.	Frecheville	Diamond Drilling (2,490')
13	Asarco Expl. Can. Ltd.	Guibord, Michaud	Diamond Drilling (13,263'), Magnetic Survey, Electromagnetic Survey
14	Asarco Expl. Can. Ltd.	Cleaver	Stripping, Geology Survey
15	Ateba Mines Inc.	McCool, Munro	Overburden Drilling (5,239'), Electromagnetic Survey
16	B.P. Resources Ltd.	Milligan	Diamond Drilling (301')
17	Bay Res. et Serv. Inc.; St. Genevieve Res. Ltd.	Milligan, Warden, Rayner Lake	Overburden Drilling (6,111')
18	Beckett,B.T.	Marriott	Electromagnetic Survey, Radiometric Survey
19	Birnie,B.	Otto	Trenching
20	Bond Gold Canada Inc.	Barnet	Diamond Drilling (4,040'), Sampling
21	Booth,W.	Coulson, Wilkie	Stripping
22	Boudreault,B.; Spadetto,G.	McGarry	Diamond Drilling (998')
23	Boulder Mountain Res.	Holloway, Marriott	Magnetic Survey
24	Brex Exploration Inc.	Cairo	Magnetic Survey, IP
25	Brex Exploration Inc.	Lebel, Morrisette	Magnetic Survey, Electromagnetic Survey, IP
26	Brothers Gold Corp.	Beatty	Geology Survey
27	Bruneau Mining Corp.	Munro	Diamond Drilling (6,629')
28	Butte Canyon Res. Inc.	Eby	Geology Survey, Magnetic Survey , Electromagnetic Survey
29	Camflo Mines Ltd.	Holloway	Diamond Drilling (16,309')
30	Campsall,L.	Coulson	Stripping
31	Canadian Nickel Co. Ltd.	Abbotsford	Overburden Drilling (1,184'), Geology Survey, Magnetic Survey, Electromagnetic Survey
32	Canadian Nickel Co. Ltd.	Adair, Hepburn	Overburden Drilling (797'), Geology Survey, Magnetic Survey, Electromagnetic Survey
33	Canamax Resources Inc.	Barnet	Diamond Drilling (8,096')
34	Canamax Resources Inc.	Harker	Diamond Drilling (751')
35	Canamax Resources Inc.	Holloway	Diamond Drilling (475')
36	Canamax Resources Inc.	Teefy	Magnetic Survey, Electromagnetic Survey
37	Canhorn Mining Corp.	Katrine	Diamond Drilling (4,385')
38	Can-Mac Exploration Ltd.	Bisley	Electromagnetic Survey, IP, Diamond Drilling (3,151')
39	Card Lake Resources Ltd.	Black	Magnetic Survey, Electromagnetic Survey
40	Casau Exploration Ltd.	Bragg, Newman	Overburden Drilling (1,546')
41	Chevron Canada Res. Ltd.	Tweed	Diamond Drilling (6,596')
42	Chevron Minerals Ltd.	Currie	Diamond Drilling (4,391'), IP
43	Chutine Resources Ltd.	Katrine, McVittie	IP

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
44	Clement,C.	Cleaver	Diamond Drilling (2,005')
45	Cleyo Resources Inc.	Cleaver	Sampling
46	Cogema Canada Ltd.	Blakelock, Hoblitzell	Airborne Magnetic Survey, Airborne Electromagnetic Survey
47	Cogema Canada Ltd.	Hoblitzell, Noseworthy	Airborne Magnetic Survey, Geochemical Survey, Airborne Electromagnetic Survey, Geology Survey, Overburden Drilling (10, 233')
48	Cominco Ltd.	Currie	Diamond Drilling (489')
49	Cominco Ltd.	Thackeray	Diamond Drilling (2,363')
50	Condaka Metals Corp.	Holloway, Tannahill	Electromagnetic Survey
51	Condie,R.	Teck	Self Potential Survey
52	Cons. Rio Plata Res.	Hislop	Geology Survey, Magnetic Survey, Electromagnetic Survey
53	Consolidated N.R.D. Resources Ltd.	Cairo	Magnetic Survey, Geology Survey, Sampling, Electromagnetic Survey
54	Continental Precious Metals Inc.	Abbotsford, Case, Singer	Airborne Electromagnetic Survey, Airborne Magnetic Survey
55	Cook, B. G.	Catharine	Magnetic Survey
56	Cosby, M.	Walker	Geochemical Survey, Sampling
57	Crichton,R.; Forbes,J.; Gagnon,R.; Thurston, M.	Baden	Airborne Electromagnetic Survey, Airborne Magnetic Survey
58	Cross Lake Minerals Ltd.	Bowman, Currie	Magnetic Survey
59	Cunningham,L.J.	Lebel	Diamond Drilling (1,112')
60	Cunningham,L.J.	Katrine	Geology Survey, Sampling, Diamond Drilling (1,510')
61	Daigle,R.; Daigle,D.	Michaud	Geology Survey
62	Dea,A. ; Dea,I.	Holmes	Trenching
63	Dea,I.	Cairo, Flavelle	Trenching
64	Dome Exploration	Kerrs	Diamond Drilling (1,764')
65	Donner,B.; Hagan,J.D.; Lammerding,E.	Midlothian, Montrose	Airborne Electromagnetic Survey, Airborne Magnetic Survey
66	Dufresne,R.	Flavelle	Stripping, Sampling
67	Edda Resources Ltd.	Morrisette	Diamond Drilling (173')
68	Esso Minerals Ltd.	Blakelock, Hoblitzell, Noseworthy	Sampling, Geology Survey, Airborne Magnetic Survey Diamond Drilling (2,012')
69	Esso Resources Ltd.	Rand	Magnetic Survey
70	Falconbridge Ltd.	Cairo	Stripping
71	Falconbridge Ltd.	Guibord, Michaud	Diamond Drilling (4,121')
72	Findore Minerals Inc.	Garrison	Magnetic Survey, Electromagnetic Survey, IP
73	559505 Ontario Ltd.	Thackeray	Geology Survey, Magnetic Survey, Electromagnetic Survey
74	Flint Rock Mines Ltd.	Grenfell	Geology Survey, Magnetic Survey, Electromagnetic Survey, Diamond Drilling (1,261')
75	Forbes,C.P.	Bannockburn, Montrose	Airborne Electromagnetic Survey, Airborne Magnetic Survey
76	Fournier, E.	Wilkie	Diamond Drilling (240')
77	Freegold Recovery Inc.	Teck	Magnetic Survey, Electromagnetic Survey, Geology Survey
78	French,G.B.	Pacaud	Stripping, Sampling
79	Gagne,Y.; St. Amand,A.	Tannahill	Trenching, Airborne Magnetic Survey, Sampling, Airborne Electromagnetic Survey
80	Gamble, S.G.	Catharine	Magnetic Survey
81	Gamble,S.G.	Lebel	Stripping
82	Garrison Gold Inc.	Hearst	Magnetic Survey, Electromagnetic Survey
83	Garrison Gold Inc.	McGarry	Electromagnetic Survey

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
84	Gilson,R.	Pacaud	Trenching
85	Ginn,A.P.	Carr	Geology Survey, Magnetic Survey, Electromagnetic Survey
86	Gleeson,C.; Rampton,V.	Melba	Airborne Electromagnetic Survey, Airborne Magnetic Survey
87	Glen Auden Res. Ltd.	Kenning, Newman, Seguin, Tomlinson	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (2,056')
88	Glen Auden Res. Ltd.	St. Laurent	Sampling, IP, Diamond Drilling (1,377'), Magnetic Survey, Electromagnetic Survey
89	Glencairn Expl. Ltd.; Utah Mines Ltd.	Bernhardt, Maisonville	Magnetic Survey, Electromagnetic Survey, Geology Survey
90	Glimmer Resources Inc.	Barnet	Magnetic Survey, Electromagnetic Survey, Overburden Drilling (3,768')
91	Golden Goose Mines Ltd.	McCool, Munro	Magnetic Survey, Geology Survey, Geochemical Survey
92	Golden Harker Expl. Ltd.	Harker	Diamond Drilling (7,703')
93	Golden Range Res. Inc.	Michaud	Diamond Drilling (2,381')
94	Golden Shaft Mines Ltd.	Hislop	Magnetic Survey, Electromagnetic Survey
95	Golden Shield Res. Ltd.	Catharine, McElroy	Geochemical Survey, Diamond Drilling (23,640')
96	Golden Trio Minerals	Sulphur Island	IP, Electromagnetic Survey
97	Golden,W.; Obradovich,T.	Tannahill	Airborne Electromagnetic Survey, Airborne Magnetic Survey
98	Goldhunter Expl. Inc.	Teck	Diamond Drilling (610')
99	Goldteck Mines Ltd.	Midlothain	Diamond Drilling (13,363')
100	Gwen Resources Ltd	Catharine	Diamond Drilling (280')
101	Harvey,R.P.	Dokis	Magnetic Survey, Electromagnetic Survey
102	Hedman Resources Ltd.	Coulson, Kerrs, Knox, Milligan, McCool, Warden, Rayner Lake	Airborne Electromagnetic Survey ,Electromagnetic Survey, Airborne Magnetic Survey, Magnetic Survey
103	Hill,R.	Catharine	Stripping
104	Hill,R.	Gauthier	Stripping
105	H. L. Mineral Holdings	Garrison	Diamond Drilling (4,260'), Sampling
106	H.L. Mineral Holdings	Chesney Bay, Galna, Hepburn, Sargeant, Steele, Northeast Bay	Overburden Drilling (3,319')
107	Hobbs,L.G.	Garrison	Geology Survey
108	Homestake Expl. Ltd.	Lebel	Diamond Drilling (1,425')
109	Horton, H.	Holmes	Airborne Electromagnetic Survey, Airborne Magnetic Survey
110	HSK Minerals Ltd.	Otto, Teck	Diamond Drilling (2,283')
111	Hudson Bay Gold Inc.	Bisley	Magnetic Survey, Electromagnetic Survey
112	Hurd,D.F.	Dunmore, Terry	Stripping
113	Hurd,D.F.	Harker	Stripping
114	Hysoex Resources Inc.	Flavelle, Gross	Magnetic Survey, Electromagnetic Survey
115	Imperial Gold Inc.	Argyle	Magnetic Survey
116	Ingamar Expl. Ltd.	Noseworthy	Airborne Electromagnetic Survey, Airborne Magnetic Survey
117	Jascan Resources Inc.	Gauthier	Magnetic Survey, Electromagnetic Survey
118	Jasperson, J.	Benoit	Electromagnetic Survey, Geochemical Survey, Stripping
119	Jennex Ltd.	Carr	Magnetic Survey, Electromagnetic Survey
120	Jomi Minerals and Expediting Ltd.	Otto, Teck	Stripping, Sampling
121	Jonpol Explorations Ltd.	Garrison	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (10,869')
122	Jonpol Explorations Ltd.	Harker	Diamond Drilling (112')
123	Joutel Resources Ltd.	Playfair	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (1,695')

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
124	Karvinen,W.O.	Bonis, Steele, Northeast Bay	Geology Survey
125	Kennedy,W.	Coulson	Stripping
126	Kerr Addison Mines Ltd.	McNeil	Diamond Drilling (7,388'), Electromagnetic Survey, Magnetic Survey
127	Kidd Creek Mines Ltd.	Michaud	Magnetic Survey, Electromagnetic Survey
128	Kiernicki, F.	Argyle, Bannockburn	Airborne Electromagnetic Survey, Stripping, Airborne Magnetic Survey
129	Kiernicki,F.	Elliott, Thackeray	Geology Survey
130	Kiernicki,F.; Leahy,M.	Powell	Stripping
131	Kimex Resources Ltd.	Cairo	Geology Survey, Magnetic Survey, Electromagnetic Survey, Geochemical Survey, Geology Survey, Sampling
132	Kinbauri Gold Corp.	Bompas	Diamond Drilling (1,532')
133	Labine, M.J.	Lebel	Stripping, Trenching, Radiometric Survey
134	Lac Minerals Ltd.	Arnold	Electromagnetic Survey, Magnetic Survey Diamond Drilling (672')
135	Lac Minerals Ltd.	Risley	Electromagnetic Survey
136	Lac Minerals Ltd.	Bowman	Magnetic Survey
137	Lac Minerals Ltd.	Clifford	Geology Survey, Electromagnetic Survey, Magnetic Survey, Diamond Drilling (1,088')
138	Lac Minerals Ltd.	Currie	Magnetic Survey
139	Lac Minerals Ltd.	Egan	Magnetic Survey
140	Lac Minerals Ltd.	Elliott	Diamond Drilling (865'), Electromagnetic Survey
141	Lac Minerals Ltd.	Garrison	Electromagnetic Survey
142	Lac Minerals Ltd.	Gauthier	Magnetic Survey ,Electromagnetic Survey , Diamond Drilling (2,736')
143	Lac Minerals Ltd.	Hearst	Magnetic Survey, Electromagnetic Survey
144	Lac Minerals Ltd.	Lebel	Diamond Drilling (1,207), Geology Survey
145	Lac Minerals Ltd.	Tannahill	Electromagnetic Survey
146	Lac Minerals Ltd.	Teck	Stripping
147	Lacana Mining Corp.	Michaud	Diamond Drilling (4,166'), Sampling
148	Lalonde, D.	Munro	Sampling
149	Laverty Red Lake Res.	McElroy	Magnetic Survey, Electromagnetic Survey
150	Leahy,M.	Lebel	Magnetic Survey, Airborne Electromagnetic Survey, Airborne Magnetic Survey, Electromagnetic Survey
151	Lencourt Ltd.	McCann	Magnetic Survey, Electromagnetic Survey, Sampling
152	Link, T.	Maisonville	Diamond Drilling (1,854')
153	Link,T.	Morrisette	Stripping
154	Link,T. ; Merrick,A.	Arnold	Diamond Drilling (400')
155	Litwicki,D.; Lourim,J.	Benoit	Sampling, Geology Survey, Sampling
156	MacGregor R. A.	Gauthier	Electromagnetic Survey, Geology Survey, Magnetic Survey
157	MacGregor, R.A.	Hearst, McFadden	Sampling, Electromagnetic Survey, Magnetic Survey, Geology Survey
158	MacGregor, R. A.	McVittie	Electromagnetic Survey, Magnetic Survey Diamond Drilling (567')
159	MacGregor,R.A.	Skead	Electromagnetic Survey, Magnetic Survey
160	Mangan,J.J.	Guibord, Michaud	Airborne Magnetic Survey, Geology Survey, Airborne Electromagnetic Survey
161	Manville Canada Inc.	Argyle, Hincks	Magnetic Survey, Electromagnetic Survey, Geology Survey
162	Manville Canada Inc.	Munro	Diamond Drilling (616')
163	Marshall,C.	Cook	Magnetic Survey, Electromagnetic Survey

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
164	Mary Ellen Res. Ltd.	Eby	Electromagnetic Survey, Magnetic Survey, Stripping, Diamond Drilling (2,045')
165	Mathias,A.; O'Connor,F.; Porritt,I.	Morrisette	Magnetic Survey, Electromagnetic Survey
166	Maude Lake Gold Mines Ltd.	Beatty, Coulson, Warden, Wilkie	Airborne Electromagnetic Survey, Magnetic Survey, Diamond Drilling (5,582'), Sampling, Airborne Magnetic Survey, Electromagnetic Survey
167	McAdam Resources Inc.	Argyle	Diamond Drilling (2,458')
168	McAdam Resources Inc.	Ben Nevis	Magnetic Survey, Electromagnetic Survey, IP, Sampling
169	McChip Resources Inc.	Powell	Geology Survey
170	Melba Gold Inc.	Benoit, Black	Airborne Electromagnetic Survey, Airborne Magnetic Survey
171	Meunier,D.	Guibord	Geology Survey
172	Meunier,D.	Michaud	Diamond Drilling (1,479')
173	Mid-North Engineering Services Ltd.	Katrine, Ossian	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (5,090')
174	Mid-North Engineering	Michaud	Diamond Drilling (2,542')
175	Mid-North Engineering	Otto	Airborne Magnetic Survey, Airborne Electromagnetic Survey
176	Mingold Resources Inc.	Bisley	Magnetic Survey, Electromagnetic Survey
177	Minnova Inc.	Teck	Magnetic Survey, Electromagnetic Survey
178	Mission Harker Expl.	Harker	Geology Report, Diamond Drilling (4,753'), IP
179	Moneta Porcupine Mines	Michaud	Diamond Drilling (1,188'), Electromagnetic Survey, Overburden Drilling (5,270'), Magnetic Survey
180	Nahanni Mines Ltd.	Michaud	IP
181	Nartico Resources Inc.	Blakelock	Geology Survey, Magnetic Survey
182	Nartico Resources Ltd.	Hoblitzell	Magnetic Survey, IP
183	Neal, H.E.	Guibord	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (270'), Geology Survey
184	Neal,H.E.	Hislop	Diamond Drilling (450')
185	Neal,H.E.	Marroitt	Geochemical Survey, Diamond Drilling (538')
186	Neighbors Resources Inc.	Grenfell	Diamond Drilling (1,689')
187	Newfields Minerals Inc.	Teck	Diamond Drilling (10,241'), Geology Report
188	Newmont Exploration Co. of Canada Ltd.	Bradette, Hoblitzell, Hurtubise, Noseworthy	Sampling, Diamond Drilling (10,925'), IP, Overburden Drilling (2,113'), Magnetic Survey, Electromagnetic Survey, Airborne Magnetic Survey, Airborne Electromagnetic Survey, Stripping
189	Newmont Exploration	Holloway, Tannahill	Overburden Drilling (3,747'), Diamond Drilling (3,324')
190	(1980) ENR Partnership	Lebel	Diamond Drilling (3,515'), Sampling, Stripping
191	Noranda Expl. Co. Ltd.	Barnet, Michaud	Overburden Drilling (2,305'), Diamond Drilling (978')
192	Noranda Expl. Co. Ltd.	Bradette	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (1,165')
193	Noranda Expl. Co. Ltd.	Garrison	Diamond Drilling (1,996')
194	Noranda Expl. Co. Ltd.	Hurtubise	Diamond Drilling (5,403')
195	Noranda Expl. Co. Ltd.	Stoughton	Diamond Drilling (2,205')
196	Noranda Expl. Co. Ltd.	Tomlinson	Diamond Drilling (1,903')
197	Nordex Explosives Ltd.	Benoit, Melba	Airborne Magnetic Survey, Airborne Electromagnetic Survey
198	North Hawk Res. Ltd.	Lamplugh, Rand	IP, Diamond Drilling (2,222')
199	Nova Beaucage Mines Ltd.	Teck	Stripping
200	Nufort Res. Inc.	Stoughton	Magnetic Survey, Electromagnetic Survey
201	Obradovich,T.	Baden	Sampling
202	Obradovich,T.	Clifford	Diamond Drilling (2,513')
203	Obradovich,T.	Guibord	Geology Survey, Electromagnetic Survey

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
204	Pamour Inc.	Beatty	Diamond Drilling (429')
205	Panthco Resources Inc.	Gauthier	Magnetic Survey, Electromagnetic Survey
206	Pegg, C. W.	Hepburn	Diamond Drilling (1,443')
207	Pelangio Larder Mines	Hislop	Electromagnetic Survey
208	Perrex Resources Inc.	Elliott, Harker	Diamond Drilling (8,454')
209	Perrex Res. Inc.	Holloway	Geology Survey, Stripping, IP
210	Perron,A.H.	Elliott	Magnetic Survey, Electromagnetic Survey
211	Perron,A.H.	Grenfell	Magnetic Survey, Electromagnetic Survey, IP, Diamond Drilling (3,808'), Stripping
212	Perron,A.H.	Harker	Geology Survey
213	Perron,A.H.	Munro	Magnetic Survey
214	Perron,A.H.	Teck	Diamond Drilling (2,322'), Sampling
215	Perron Gold Corp.	Holloway, Marriott	Magnetic Survey
216	Peter Island Res. Inc.	Argyle	Diamond Drilling (1,445')
217	Peter Island Res. Corp.	Black	Diamond Drilling (2,163')
218	Petromet Res. Ltd.	Argyle	Stripping
219	Placer Dome Inc.	Blakelock	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (472')
220	Placer Dome Inc.	Egan	Magnetic Survey, Electromagnetic Survey
221	Placer Dome Inc.	Playfair	Magnetic Survey, Electromagnetic Survey
222	Point Comfort Res. Inc.	Milligan, Warden, Rayner Lake	Magnetic Survey
223	Premier Expl. Co. Ltd.	Bayly	Airborne Magnetic Survey, Airborne Electromagnetic Survey
224	Proteus Resources Ltd.	Garrison	Diamond Drilling (756')
225	Pyke, D.R.	Carr	Stripping
226	Raney Minerals Ltd.	Rickard, Teefy	Magnetic Survey
227	Raney Minerals Ltd.	Warden	Magnetic Survey, Electromagnetic Survey
228	Raven Resources Inc.	Burt, Eby, Gross	Airborne Magnetic Survey, Airborne Electromagnetic Survey
229	Regal Petroleum Ltd.	Holloway	Magnetic Survey, Electromagnetic Survey, Geology Survey
230	Regent Rock Res. Ltd.	Cairo	Magnetic Survey, Electromagnetic Survey, IP
231	Regent Rock Res. Inc.	Melba	IP
232	Rio Plata Resources Ltd.	Hislop	Geology Survey, Diamond Drilling (375')
233	Rivard,P.	Otto	Stripping
234	Rodholm, C.	Benoit	Sampling , Stripping, Trenching
235	St. Denis	Mortimer	Trenching
236	St. Joe Canada Inc.	Barnet,Cook, Guibord, Michaud	Geology Survey,Magnetic Survey, Diamond Drilling (7,118')
237	St. Joe Canada Inc.	Bowman	Diamond Drilling (1,470')
238	St. Joe Canada Inc.	Frecheville	Magnetic Survey, Electromagnetic Survey
239	Seal River Exploration	Abbotsford, Hepburn	Airborne Magnetic Survey, Airborne Electromagnetic Survey
240	Shenandoah Res. Ltd.	Boston, Catharine, McElroy	Stripping, Sampling, Diamond Drilling (1,297')
241	Sheridan,J.P.	Currie	Magnetic Survey, Electromagnetic Survey
242	Sheridan,J.P.	Rand	Sampling
243	Sholia Resources Ltd.	Milligan, Warden, Rayner Lake	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (550')
244	657873 Ontario Ltd.	Gauthier	Magnetic Survey ,Electromagnetic Survey
245	612378 Ontario Inc.	Argyle	Airborne Magnetic Survey, Airborne Electromagnetic Survey
246	Skead Holdings Ltd.	Hearst, McElroy	Airborne Magnetic Survey, Airborne Electromagnetic Survey

TABLE 13.3 Continued

Number on Figure	Individual or Company		Activity
247	Skead Holdings Ltd.	Gauthier, McVittie	Geology Survey, Diamond Drilling (3,125')
248	Skjonsby, K.E.	Benoit	Diamond Drilling (135')
249	Smith,D.E.	Garrison	Diamond Drilling (2,641')
250	Snodden,L.	McCool	Diamond Drilling (55'), Trenching
251	Stellar Resources Ltd.	Michaud	Magnetic Survey, Electromagnetic Survey
252	Stewart,A.K.	Bompas	Sampling
253	Stewart,A.K.	Teck	Stripping, Sampling
254	Strike Minerals Inc.	Baden	Stripping
255	Sylkroy Resources Inc.	McCool	Magnetic Survey, Electromagnetic Survey, Geology Survey
256	Teck Explorations Ltd.	Catharine, Pacaud	Geology Survey, Magnetic Survey,Electromagnetic Survey, Diamond Drilling (4,197'), Sampling
257	Union Mining Corp.	Elliott	Stripping
258	United Reef Petroleum	Katrine, Ossian	IP
259	Utah Mines Ltd.	Bonis, Steele, Northeast Bay	Magnetic Survey, Electromagnetic Survey
260	Vallier, B.W.	Grenfell	Diamond Drilling (109')
261	Ventex Energy Ltd.	Clifford	Diamond Drilling (2,973')
262	Villeneuve Resources Ltd.	Benoit, Maisonville	Magnetic Survey, Electromagnetic Survey, Diamond Drilling (5,530')
263	Wahgoshig Dev. Corp.	Rand	Geology Survey
264	Wilzel Resources Ltd.	Argyle,Bannockburn, Hincks	Airborne Electromagnetic Survey, Trenching, Airborne Magnetic Survey, Stripping, Diamond Drilling (1,502')
265	Wilzel Resources Ltd.	Cook	Geology Survey, Diamond Drilling (1,300')
266	Wilzel Resources Ltd.	Coulson	Diamond Drilling (1,614')
267	Winteroad Resources Ltd.	Garrison	Diamond Drilling (528')
268	Yellow Sands Prospecting	McCool, Millgan, Munro, Rayner Lake	Airborne Electromagnetic Survey, Airborne Magnetic Survey
269	Yost, C.; Yost, R.	McElroy	Stripping
270	Zabudsky, D.	Otto	Stripping

ADVANCED EXPLORATION AND DEVELOPMENT

Underground exploration and development, at varying stages of completion, was performed at 14 locations.

Armistice Resources Ltd.

Armistice Resources, on their optioned property adjoining the Kerr Mine property, are carrying out a two- to three-year shaft-sinking and drilling program. The shaft rehabilitation has been completed to a depth of 1250 feet and drilling has been started from this level. The company intersected several gold-bearing sections in two long-holes drilled from the 1250 Level. The best intersection is 0.427 ounce gold per ton for a core length of 34.8 feet with a true width estimated at 50 percent of the core length (The Northern Miner, October 3, 1988; October 31, 1988).

Equinox Resources Ltd.—Technigen Corporation

Equinox Resources and joint venture partner Technigen Corporation conducted underground exploration at Maude Lake Gold Mines Ltd.'s No. 5 gold deposit, where drill-indicated reserves were reported to be 1 million tons averaging 0.204 ounce gold per ton (Equinox Resources Ltd., 1987 Annual Report). By September, Technigen (as operator) had extended a decline ramp 760 m to the 140 m level, completed 200 m of crosscutting, 500 m of drifting, 250 m of raising, 3000 m of underground diamond drilling, and 3000 m of surface diamond drilling (George Cross News Letter, September 12, 1988). A recent mining feasibility study on the deposit developed proven mineable underground reserves of 130 000 tons grading 0.158 ounce gold per ton (diluted, uncut) to a depth of 500 feet, and probable open pit reserves of 45 000 tons grading 0.11 ounce gold per ton to a depth of 70 feet (George Cross News Letter, No. 250, December 30, 1988).

Golden Shield Resources Ltd.

Golden Shield Resources holds a 42 percent interest in the Larder Lake project which includes the Cheminis, Barber Larder, and Fernland mines. The Cheminis Mine is developed by a 1085-foot shaft and 5324 feet of lateral work (Canadian Mines Handbook 1988-89). Golden Shield recently decided to put its long-term exploration development goals on hold and 30 people were laid off (Northern Daily News, November 21, 1988). Gold Vessel Resources Inc. revised the Larder Lake project agreement with joint venture partners Golden Shield, Rockford Minerals Inc., Northfield Minerals Inc., and Northern Ranger Minerals Inc. Gold Vessel Inc. previously had to spend $15 million on exploration before March 1, 1990, now changed to $7.5 million, to earn a 24 percent interest in the Larder Lake project. A production decision for the Cheminis Mine depends on the results of bulk sampling scheduled to be taken from the A and C zones (The Northern Miner, November 28, 1988, p.20).

Goldpost Resources Inc.

Goldpost Resources continued to explore its properties in Hislop Township. On the Hislop West gold deposit, exploration is continuing via a decline ramp. Goldpost completed a ground magnetic survey and 2000 feet of ramping, 551 feet of drifting, and 11 971 feet of underground diamond drilling as of late November 1988. On the Hislop East property (formerly operated by New Kelore Mines Ltd.), underground exploration via two decline ramps was initiated by Goldpost. During 1988, the eastern decline was extended 1384 feet from surface and the main decline was extended 3271 feet from surface, breaking into the old New Kelore workings on the vertical 180-, 300-, and 450-foot levels. Goldpost also completed 24 765 feet of surface diamond drilling and 5461 feet of underground diamond drilling on its Hislop East Property as of late November 1988. Reserves of 619 000 tons averaging 0.19 ounce gold per ton have been delineated above the 450-foot level (The Northern Miner, July 4, 1988; October 3, 1988).

Goldteck Mines Limited

Goldteck Mines, on their Stairs Property, Midlothian Township, have completed nearly 65 000 feet of diamond drilling and dewatered the underground workings to the 350-foot level. Drilling has confirmed the extension of the Pope vein below the mine workings (The Northern Miner, August 1, 1988).

Inco Gold Company—Queenston Gold Mines Limited

Inco Gold (65 percent) and Queenston Gold Mines (35 percent) have completed testing a 30 000 ton bulk sample from their Anoki Project, Gauthier Township, and a feasiblility study will be completed in early 1989. A decline was driven to the 750-foot level and connected to previous mine workings on the 350-, 476-, 600-, and 735-foot levels. Total expenditures for the project are $7 million (C.E. Page, Director, Queenston Gold Mines Limited, personal communication, December 2, 1988).

Lenora Explorations Ltd.

Lenora Explorations continued programs of both surface diamond drilling and underground exploration work on its 100 percent owned Golden Harker Deposit in southeastern Harker Township, where reserves of 500 000 tons averaging 0.16 ounce gold per ton are present, with a "mineable inventory" of 270 000 tons of material averaging 0.19 ounce gold per ton (The Northern Miner, October 3, 1988). During the period 1987 to 1988, Lenora excavated a decline ramp to the (vertical) 500-foot level and established direct access to old workings on the 125-, 250-, 375-, and 500-foot levels, with access to the 375-foot level provided by 131 feet of drifting from the ramp. A total of 2050 linear feet of old drifts were slashed to 10 foot by 10 foot dimensions (amounting to about 173 841 cubic feet of slashing), 125 feet of raising were completed, and 6000 tons of rock averaging 0.115 ounce gold per ton and 10 500 tons of rock averaging 0.051 ounce gold per ton were stockpiled on surface. Seventy-five diamond-drill holes totalling 26 432 feet were also completed (Carmichael 1988). Continued exploration on the property is planned for 1989.

During the year, a haulageway was established on the 300 m level of the Holt-McDermott Mine to access parts of the auriferous zone, located on the Worvest and Three Star properties, where reserves of a 1 million ton deposit averaging 0.14 ounce gold per ton, and of a 750 000 ton deposit averaging 0.15 ounce gold per ton have been delineated, respectively (The Northern Miner, October 3, 1988). American Barrick has a 65 percent interest, and Lenora Explorations Ltd. has a 35 percent interest in both the Three Star and Worvest properties.

Newfields Minerals Inc.

Newfields Minerals, during 1988 and up to November 15th, completed on the Teck Hughes, Kirkland Basin, and Lake Shore properties a total of 6390 feet of drifting, 37 608 feet of surface diamond drilling, and 21 262 feet of underground diamond drilling. The so-called "Narrows Break" and other exploration targets are explored via the No. 5 Lake Shore shaft at the 3075-foot level on the adjoining Lac Minerals property. Drill-indicated reserves of 400 000 tons averaging 0.25 ounce gold per ton have been outlined.

Perrex Resources Inc.—Alberta Gold Exploration Corporation

Perrex Resources and Alberta Gold Exploration completed an IP survey and diamond drilled about 40 holes totalling about 26 000 feet on Iris Gold Mines Ltd.'s patented claims in southeastern Harker Township. Here, diamond drilling has delineated 780 000 tons of near surface material averaging 0.11 ounce gold per ton within an albite syenite plug. Significant tungsten (as scheelite) tenors are also reported to accompany this gold mineralization

(George Cross Newsletter, July 7, 1988; The Northern Miner, August 29, 1988). Also during the year, the joint venture partners blasted a 10 foot by 10 foot by 500 foot long exploration ramp to bulk sample the gold–tungsten mineralization. Bulk samples from the mineralized zone (intersected after 420 feet of ramping) are currently (November 1988) stock–piled on surface and await metallurgical testing which will include establishing a reliable tungsten tenor. A feasibility study concerning the mineralized zone's open pit mining potential has been initiated (A.H. Perron, President, Perrex Resources Inc., personal communication, November 24, 1988).

Queenston Gold Mines Limited—Lac Minerals Ltd.

Queenston Gold Mines and Lac Minerals have reached an agreement on the Kirkland West Property. As part of this agreement, Lac is committed to completing a minimum of 5000 feet of drifting on three levels (5875 feet, 6450 feet, and 7040 feet) and 15 000 feet of underground diamond drilling (The Northern Miner, April 25, 1988). By the end of November 1988, Lac had completed 1200 feet of crosscutting and drifting and is presently (December 1988) drifting on the "04 Break" on the 6450– and 7050–foot levels. Approximately 2000 feet of diamond drilling were also completed (C.E. Page, Director, Queenston Gold Mines Limited, personal communication, December 2, 1988).

St. Andrew Goldfields Ltd.

In Taylor Township, St. Andrew Goldfields completed 13 629 feet of diamond drilling from surface on the Shoot Zone gold deposit, where reserves of a drill–defined 1.743 million ton deposit average 0.13 ounce gold per ton (The Northern Miner, June 13, 1988). At the St. Andrew Goldfields Porphyry Zone gold deposit (also in Taylor Township), underground exploration continued via a vertical 565–foot, 3–compartment shaft. Here, St. Andrew Goldfields completed 99 feet of drifting; 365 feet of crosscutting; and 217 feet of raising on the first (200–foot vertical) level; 226 feet of raising on the second (325–foot) level, with 27 feet of crosscutting; 198 feet of raising on the third (474 foot) level; and 545 feet, 365 feet, and 394 feet of lateral development work on the 101, 201, and 301 sublevels, respectively. Diamond drilling during the year at the Porphyry Zone included 23 789 feet from surface and 18 170 feet from underground. A total of 16 154 tons of Porphyry Zone auriferous material were also stockpiled on surface as of late November 1988.

Toburn Gold Mines Ltd.

Toburn Gold Mines plans to rehabilitate the Toburn Mine headframe and shaft and begin renewed exploration of the underground workings.

EXPLORATION ACTIVITIES

CAN–MAC Exploration Ltd.

CAN–MAC Exploration has completed a 4200–foot diamond–drill program on their Boston Township Property. Several gold–bearing intersections were reported (The Northern Miner, May 16, 1988).

Destiny Resources Ltd.—Noranda Exploration Company, Limited

Destiny Resources and Noranda Exploration have released results for several gold intersections for their North and South zones, Windjammer Project, in Garrison and Michaud townships (George Cross News Letter, May 5, 1988; June 14, 1988; September 8, 1988).

ERG Resources Inc.

ERG Resources has acquired 32 million t of gold tailings in the Kirkland Lake area from Jimberlana Holdings Corp. (Northern Daily News, March 8, 1988).

Falconbridge Limited—Coniagas Mines Limited

Falconbridge Limited (as operator) and joint venture partner Coniagas Mines continued to explore, via diamond drilling, the Falconbridge–Garrison Creek Consolidated Mines Ltd. Ludgate Lake Deposit in central Michaud Township. Diamond drill–indicated reserves are reported to be about 1 million tons of material averaging 0.09 to 0.10 ounce gold per ton (The Northern Miner, March, 1988; March 7, 1988; June 11, 1988; July 25, 1988).

Glen Auden Resources Limited

Glen Auden Resources had commitments from its joint venture partners at the end of the 1987 fiscal year to spend about $12.5 million within three years, 80 percent of which was targeted for the Burntbush–Casa Baradi area. Since then, Glen Auden has entered joint–venture agreements that could lead to almost $5.6 million more in additional spending in the area by Royex Gold Mining Corp. (The Globe and Mail, June 23, 1988).

Glimmer Resources Inc.—Canamax Resources Inc.

Glimmer Resources and Canamax Resources have completed 13 diamond–drill holes on their 132–claim property in Barnet Township. The best reported intersection is 0.2 ounce gold per ton across 6.6 feet (The Northern Miner, May 2, 1988).

Inco Gold Company—Queenston Gold Mines Limited

Inco Gold and Queenston Gold Mines completed two drilling programs on their Esker–Biroco joint venture in Lebel and Gauthier townships. In the first phase, completed at the end of June, two cross sections were tested by 26 000 feet of diamond drilling in 19 holes. Two separate gold-bearing zones were intersected: 23.1 feet grading 0.133 ounce gold per ton, and 48 feet grading 0.10 ounce gold per ton. Follow-up drilling of 10 600 feet in 10 holes, in the second phase, has now been completed and results for two holes received are 38 feet grading 0.122 ounce gold per ton and 28 feet grading 0.196 ounce gold per ton (C.E. Page, Director, Queenston Gold Mines Limited, personal communication, December 2, 1988).

Inco Gold and Queenston Gold Mines signed a $5 million deal to explore Queenston's Upper Canada Mine property, Gauthier Township (Northern Daily News, June 1, 1988). Approximately $800 000 was spent by the end of November and 20 000 feet of diamond drilling in 43 holes were completed to test, near surface, five gold-bearing zones (C.E. Page, Director, Queenston Gold Mines Limited, December 2, 1988).

Jonpol Explorations Limited

Jonpol Explorations acquired a 100 percent interest in the Garrcon Mines Ltd. property in north-central Garrison Township, where diamond drilling by Jonpol and former joint venture partner Cominco Ltd. established drill-defined reserves of 350 900 tons averaging 0.19 ounce gold per ton. Lac Minerals Ltd. acquired an option to earn an interest in several properties in north-central Garrison Township, including the Garrcon Property, in which Jonpol Group companies hold interests.

Jonpol Explorations Ltd. and joint venture partners T & H Resources Ltd. and Coastoro Resources Ltd. diamond drilled more than 132 000 feet on Newfield Mines Ltd.'s patented claims in north-central Garrison Township, and established drill-indicated reserves of 1.3 million tons averaging 0.231 ounce gold per ton. Late in 1988, Lac Minerals Ltd. optioned the property (The Northern Miner, November 21, 1988) and is evaluating the possibility of processing material from it at Lac's Macassa Mine mill, in Kirkland Lake (The Northern Miner, September 5, 1988; October 10, 1988).

Meridor Resources Limited

Meridor Resources drilled a total of 2500 feet in two holes on their Garrison Township claims. The best reported intersections were 4.6 feet at 0.239 ounce gold per ton and 3.9 feet at 0.139 ounce gold per ton (George Cross News Letter, April 15, 1988).

Mineta Resources Ltd.

Mineta Resources, on their 12-claim Clifford Township Property have drilled a total of 2862 feet in eight holes. Assay results for the first four holes have been returned and the best value reported is four feet of core grading 3.55 ounces gold per ton (George Cross News Letter, May 19, 1988).

Morgain Minerals Inc.—Orcana Resources Limited

Morgain Minerals and Orcana Resources have signed an option agreement with Findore Minerals Inc. to acquire a 75 percent interest in 21 unpatented Munro-Pipestone claims and a 65 percent interest in 5 patented Newfield Mines claims in Garrison Township. To earn this interest, Morgain and Orcana have committed to spend $1.5 million in exploration and a cash payment of $67 500 (George Cross News Letter, February 10, 1988).

Newfields Minerals Ltd.

Newfields Minerals reached an agreement "in principle" with the Queenston Group of Companies to conduct exploration on two Sylvanite claims owned by Queenston. Exploration is scheduled to proceed by heading west from the Toburn Mine shaft, with the claims being explored at several levels down to 1200 feet (Northern Daily News, November 2, 1988).

Noranda Exploration Company, Limited—Alban Explorations Ltd.

Noranda Exploration and Alban Explorations completed six diamond-drill holes near the old No. 2 shaft on the Hislop Gold Mines Ltd. gold property, Hislop Township. Several gold-bearing intersections were reported with one intersection at 0.112 ounce gold per ton across a core length of 54.5 feet (Alban Explorations, News Release, October 31, 1988).

Noranda Exploration Company, Limited—Freewest Resources Inc.

Noranda Exploration and Freewest Resources have intersected a diamond-drill core length of 57.4 feet averaging 0.17 ounce gold per ton at a vertical depth of 1250 feet at their joint venture Harker-Holloway project (The Northern Miner, November 21, 1988).

Nortek Energy Corp.

Nortek Energy, on the Shenandoah Resources-Miller Independence claims early this year, reported completion of 3371 feet in 13 drillholes constituting about 35 percent of the scheduled total drilling program. The first 10 holes suggest gold values might exceed the previously indicated 500 000-ton deposit grading at 0.32 ounce gold per ton. One hole intersected 10.5 feet of core grading 3.05 ounces gold per ton (George Cross News Letter, December 8, 1987; The Northern Miner, January 25, 1988).

Pacific Trans-Ocean Resources Ltd.

Pacific Trans-Ocean Resources has begun an exploration program on property optioned from Mary Ellen Resources Ltd., in Eby Township, six miles west of Kirkland Lake. Pacific Trans-Ocean can earn a 49 percent interest in the property by spending $1.5 million on exploration and making property payments of $150 000 to Mary Ellen by February 28, 1990 (The Northern Miner, January 11, 1988).

Pamour Minerals Inc.—Queenston Gold Mines Limited

Pamour Minerals and Queenston Gold Mines announced the letter of intent, whereby Pamorex Minerals Inc. would be entitled to earn 51 percent in Queenston's Upper Beaver Mine gold property in Gauthier Township (The Northern Miner, November 21, 1988).

Silverside Resources Inc.—Proteus Resources Inc.—Lac Minerals Ltd.—Perrex Resources Limited

Silverside Resources, Proteus Resources, Lac Minerals, and Perrex Resources continued to perform ground geophysical surveys and diamond drilling on and near the old Buffonta Mines gold deposit, where collective diamond drill–indicated reserves of 410 000 tons in the No. 5 and No. 6 gold deposits average 0.17 ounce gold per ton. The joint venture partners recently delineated in a third zone containing 200 000 tons of material averaging 0.19 ounce gold per ton (The Northern Miner, November 21, 1988).

Stroud Resources Ltd.—Chevron Canada Resources Ltd.

Diamond drilling by joint venture partners Stroud Resources and Chevron Canada Resources, on the former Gunnar Gold Mines Ltd. property in Hislop Township, continued during 1988. Stroud Resources reported that drill–indicated reserves in the Creek Zone (one of three anomalously auriferous areas known to exist on that property) were 400 000 tons of material averaging 0.20 ounce gold per ton (Stroud Resources Inc., News Release, May 17, 1988).

Westbank Resources Inc.—Newfields Minerals Ltd.

Westbank Resources, name to be changed to Northbank Resources Inc., and Newfields Minerals have discovered a polymetallic showing on their property in Ben Nevis Township. Sampling of the mineralized zone has yielded erratic assays of lead, zinc, gold, and silver (The Northern Miner, November 7, 1988, p.3).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Classified staff at the Kirkland Lake Resident Geologist's Office includes: Gerhard Meyer, Resident Geologist; Gary Grabowski, Staff Geologist; Faye M. Boucher, Administrative Secretary; Howard Lovell, Regional Staff Geologist; David Guindon, Drill Core Library Geologist; and Marc Gaudreau, Drill Core Library Assistant.

Todd Beckett, Data Geologist, worked on contract for 11 months. Mike Gleave, Rhonda Goodman, Keith McCombe, and Roger Cameron worked on the Experience '88 Program. Kelly Johnston provided clerical assistance under the Futures Program.

Mike Woods provided geological assistance to the Regional Staff Geologist for six months.

The Operation Black River–Matheson (BRiM) Project Geologist was Alexander Bath and support services were provided by Tony Zidar, Geological Assistant, and Kimberley Rose, Clerk Typist.

The Environmental Youth Corps project in conjunction with the town of Kirkland Lake, The Rotary Club, and the Ministry of Northern Development and Mines employed Terry Melong and Sheri Grabowski as Co–ordinators for the program.

Activity at this office remains at a high level this year with more than 2100 visitors using the office. Field trips showing the local geology were provided for exploration, government and university geologists, as well as geologists and students from Germany, Finland, and Chile.

Assessment work representing 654 132 man–days was added to the assessment files and more than 300 articles were added to the Technical Library.

A number of active projects, developing mines, and operating mines were visited during the year by the Resident Geologist and his staff.

Mineral potential evaluations for property re–zoning applications were done at the request of the Ministry of Municipal Affairs, for the towns of Kirkland Lake and Matachewan.

In conjunction with the ministries of Labour and Natural Resources, reportedly abandoned mining hazards were inspected and types of rehabilitation were recommended.

Once again this year, a small crew of Junior Rangers based at the Esker Lakes Provincial Park upgraded popular field trip stops by stripping overburden and bleaching outcrops.

RESEARCH BY RESIDENT OFFICE STAFF

DRILL CORE STORAGE PROGRAM

by D. Guindon

The Drill Core Library for the Kirkland Lake Resident Geologist's District was opened in June of 1984. At present, 166 136 m of core are stored, representing 247 927 m of drilling. In 1988, approximately 12 360 m of drill core were collected, catalogued, and stored. Approximately 10 700 m of core will go to Cobalt in the future. The core destined for Cobalt has been palletized and is stored at our outside storage location. Figure 13.4 shows the location of the drillholes from which the core has been stored in the library. Table 13.4 lists a sum-

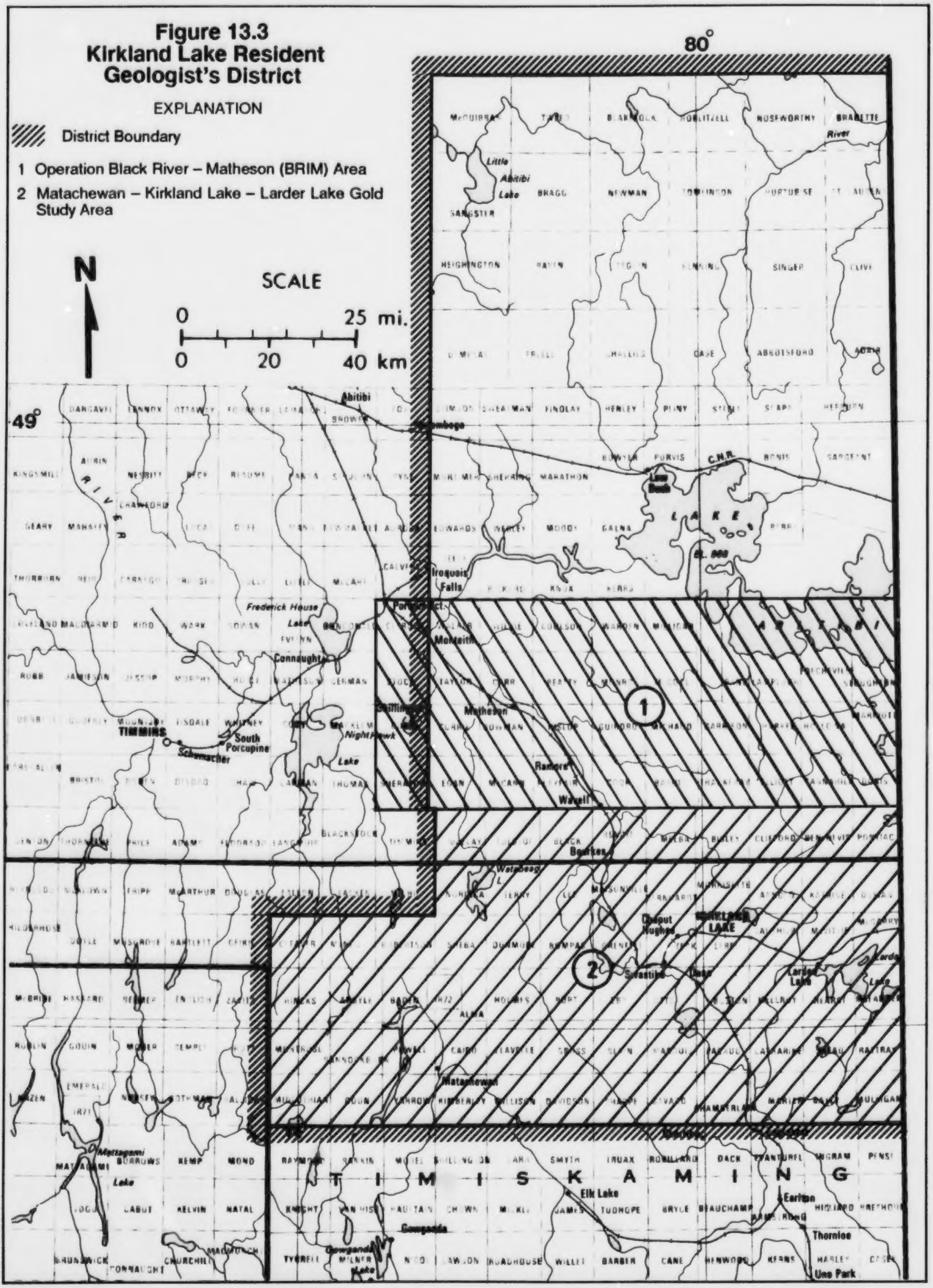

Figure 13.3 Kirkland Lake Resident Geologist's District

EXPLANATION
District Boundary
1 Operation Black River – Matheson (BRIM) Area
2 Matachewan – Kirkland Lake – Larder Lake Gold Study Area
N
SCALE
0
25 mi.
0
20
40 km
80°
49°
Little Abitibi Lake
Abitibi
Iroquois Falls
Frederick House Lake
Connaught
Monteith
Matheson
Ramore
Timmins
Schumacher
South Porcupine
Night Hawk Lake
Wavell
Boston Creek
Kirkland Lake
Swastika
Chaput Hughes
Larder Lake
Matachewan
Mattagami Lake
Elk Lake
Gowganda
Gowganda Lake
Earlton
Thornloe
Uno Park
CNR
LAKE
TIMISKAMING
ABITIBI
1
2

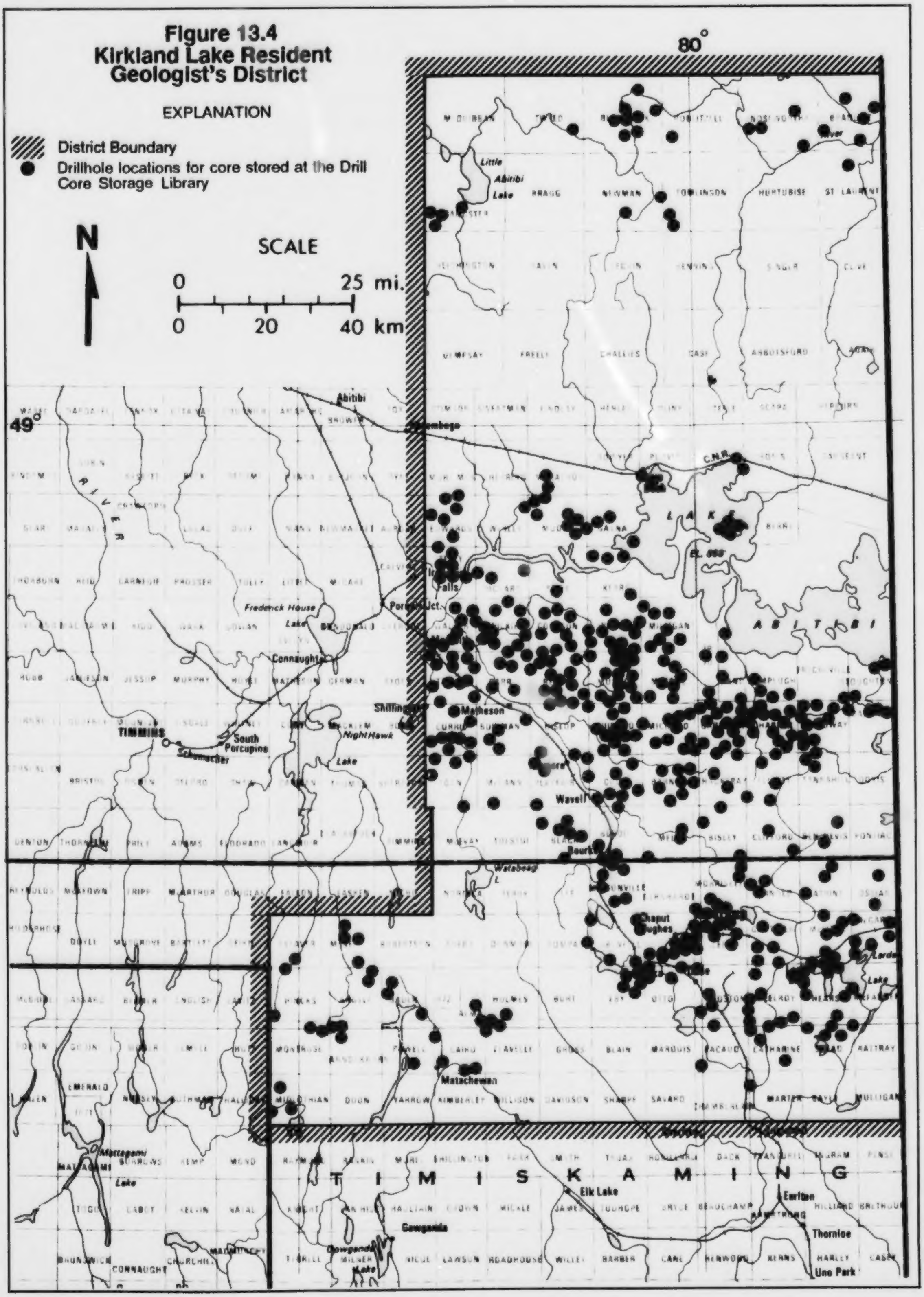

Figure 13.4
Kirkland Lake Resident Geologist's District

EXPLANATION
▨ District Boundary
● Drillhole locations for core stored at the Drill Core Storage Library
N
SCALE
0
25 mi.
0
20
40 km
80°
49°
Little Abitibi Lake
Abitibi
C.N.R.
LAKE ABITIBI
RIVER
Frederick House Lake
Porquis Jct.
Connaught
Shillington
Matheson
TIMMINS
Schumacher
South Porcupine
Night Hawk Lake
Wavell
Bourkes
Watabeag L.
Chaput Hughes
Larder Lake
Matachewan
Mattagami Lake
TIMISKAMING
Elk Lake
Gowganda
Gowganda Lake
Earlton
Thornloe
Uno Park

TABLE 13.4. SUMMARY OF NEW CORE SINCE JANUARY 1, 1988.

TOWNSHIP/AREA	NUMBER OF HOLES	TOTAL DEPTH (m)	CORE STORED INSIDE (m)	CORE STORED OUTSIDE (m)
BADEN	13	1237.9	547.4	554.1
BARNET	5	174.5	9.5	56.1
BEATTY	16	2445.3	324.7	454.0
BISLEY	2	363.0	316.7	0.0
BOSTON	1	270.4	266.4	0.0
CARR	3	241.7	6.9	4.0
COOK	8	343.5	14.4	53.0
COULSON	15	893.6	43.2	84.4
CURRIE	8	382.4	42.8	171.0
DOKIS	3	92.2	5.0	27.2
EGAN	2	75.3	3.6	0.0
ELLIOTT	6	171.8	11.7	26.5
FRECHEVILLE	3	236.8	12.8	16.4
GALNA	1	159.4	0.3	0.0
GARRISON	11	2060.6	783.6	0.0
GAUTHIER	2	338.9	321.9	0.0
GRENFELL	2	237.5	0.5	0.0
GUIBORD	19	3397.6	7.9	40.3
HARKER	5	184.7	12.2	48.6
HEARST	1	349.6	4.0	0.0
HISLOP	1	132.6	0.6	0.0
HOLLOWAY	17	3376.5	877.6	2288.9
IROQUOIS POINT	3	90.8	3.6	19.8
LAMPLUGH	6	293.7	13.7	170.8
LEE	1	80.5	0.1	0.0
MAISONVILLE	2	342.6	1.3	0.0
MARRIOTT	3	57.4	3.9	4.4
MCCOOL	1	39.6	1.2	8.8
MCELROY	1	303.9	3.0	0.0
MCFADDEN	1	306.3	285.3	0.0
MCGARRY	3	164.9	131.4	0.0
MICHAUD	3	109.4	6.2	42.0
MILLIGAN	4	160.0	6.5	19.4
MISTAKEN ISLANDS	1	15.2	2.4	0.0
MOODY	1	150.3	85.0	0.0
MORRISETTE	2	113.1	107.3	0.0
MUNRO	5	676.7	351.3	288.1
PLAYFAIR	1	25.9	2.6	1.8
RAND	3	142.2	5.3	22.8
STOUGHTON	5	125.3	9.0	23.2
SULPHUR ISLAND	7	921.7	689.2	0.0
TANNAHILL	8	219.6	17.2	61.8
TAYLOR	6	1329.4	895.6	0.0
TECK	2	2274.2	1385.0	0.0
THACKERAY	1	25.9	1.4	0.0
WALKER	6	334.5	36.6	58.1
WARDEN	6	334.0	14.2	36.4
WILKIE	10	709.8	25.8	76.2
TOTAL	236	26512.7	7697.8	4658.1

mary of 1988 core stored for each township, by company name.

The computer system at the core libraries has been updated. More information is stored, with the ability to cross reference holes based on multiple alternate and property names. Data searches may be completed on any combination of the following criteria: company or property name, township, UTM area, NTS area, claim number, entry or change date, assay data, company hole number, and inside or outside storage.

The core library is located west of Kirkland Lake, on the southern side of Highway 66, at the Ministry of Natural Resources District Office. Persons wishing to examine or donate core should telephone (705) 642–3222 Ext. 169, or write to:

Ontario Ministry of Northern
Development and Mines
Drill Core Library
P.O. Box 129
Swastika, Ontario
P0K 1T0.

MATACHEWAN–KIRKLAND LAKE–LARDER LAKE GOLD STUDY

by H. Lovell

1988 was the first full 12–month calendar year of this four–year project carried out by the northeastern Ontario Regional Staff Geologist. Sedimentary (mechanical, chemical and biochemical) aspects, in particular, of the primary localization of gold are being investigated.

During 1988, the majority of the time was applied to field work that consisted of geological mapping; surface, open pit, and underground property examinations; and logging diamond–drill core. Part of the field work entailed preserving, in the form of photographic slides, prints, and field notes, significant geological phenomena exposed mainly by the exploration industry, which stripped and pressure–hosed the overburden from glacially polished surfaces before extensive blasting was done preparatory to bulk sampling. Illustrative rock samples were taken and cut using a circular diamond–studded saw. The cut surface was then polished or coated with a polymer, thereby clarifying textures and structures. Other field work comprised mapping in greater detail and sampling a number of areas and properties that are geologically and economically significant, and relogging several hundred metres of important diamond–drill core.

The remainder of the time was spent in the office in the Kirkland Lake Drill Core Library, summarizing and compiling geological literature pertinent to the gold study, writing up field notes on preliminary examinations of 34 properties, conducting office consultations, and drafting the first few of a planned series of overlays of various types of maps of the study area at a scale of 1:100 000.

OPERATION BLACK RIVER–MATHESON (BRiM)

by A. Bath

Operation Black River–Matheson (BRiM) is a multidisciplinary program focussed on 40 townships extending from Night Hawk Lake, eastward to the Ontario–Quebec interprovincial boundary (Figure 13.3). Funded by the Ontario Ministry of Northern Development and Mines, the program has been designed to stimulate the economy of northern Ontario in the long term, via mineral exploration incentives. These incentives are provided through the development of a geoscience data base which will contribute to the discovery of mines. The goals of the program have been realized through contributions from the Geophysics/Geochemistry Section, Precambrian Geological Section, and the Kirkland Lake and Timmins Resident Geologist's offices.

On–Going Activities

1988 was the final year for which regular field and compilation studies of the BRiM program were scheduled. During February and March, geologists with the Engineering and Terrain Geology Section of the Ontario Geological Survey completed the final phase of a multi–year program of rotasonic overburden drilling in the BRiM area (Steele 1988a). The 1988 program included the drilling of 52 holes totalling 1801 m. Twelve of these holes were designed to establish local–scale overburden stratigraphic relationships and trends, while the remaining 40 holes were spotted to generate additional data pertaining to the area's regional–scale overburden stratigraphy. A gold grain distribution map based on the results of the 1988 drilling program was released in July (Steele 1988b). Data sheets providing further descriptive, heavy mineral distribution and chemical information resulting from the 1988 drilling program, and updated bedrock geological maps generated from the results of the 1988 and prior overburden drilling programs, are expected to be released in early 1989. Data sheets detailing the results of the 1987 overburden sampling programs (Steele and Baker 1987) appeared during 1988 (as summarized within Table 13.5) and literature contributions based on the BRiM rotasonic drilling programs (Steele *et al.*, in press; Bloom and Steele, in press) were submitted during 1988. Data from the 1984, 1985, 1986, and 1987 BRiM overburden sampling programs were released in floppy disc format during the year. It is anticipated that the results of the 1988 overburden sampling program will also be released in the near future.

As part of BRiM, an economic geologist is based in Kirkland Lake to encourage exploration activity at the local level by being available to all members of the exploration community, and as a source of exploration–related information and advice. Efforts of the economic geologist are directed towards promoting the BRiM area, catalyzing the property–optioning process, interfacing between the public and private sectors and, in general, providing services that facilitate exploration. Specifically, the economic geologist is available to

1. Assist prospectors with property visits, advice, and assessment file searches
2. Document new mineral occurrences
3. More fully describe previously documented mineral occurrences
4. Compile data relevant to exploration
5. Help "orient" workers new to the area

Activities of the BRiM economic geologist during 1988 consisted of leading field trips, making oral presentations to university students, logging core, completing a limited number of property examinations and compiling mineral occurrence information. The final report resulting from the Black River–Matheson Economic Geologist Program will consist of about 280 precious metal, base metal, and industrial mineral occurrence, deposit and mine descriptions based on field and compilation work per-

TABLE 13.5. ONTARIO GEOLOGICAL SURVEY MAPS AND REPORTS PERTAINING TO THE BRIM AREA, RELEASED BY BETWEEN DECEMBER 1987 AND JANUARY 1988.

Township or Area	Reports	Maps
General	MP 139, MP 140 (1)	P.3130
BRiM Area	MP 141 OFR 5677, OFR 5688 (2)	
Barnet		81115, 81116, 81117
Beatty		81101, 81103
Bond		81126, 81127
Bowman		
Carr		
Clergue		
Cook		81121, 81122, 81123
Coulson		81099, 89100, 89101 89102
Currie		81124, 81125, 81130 81131, 81132, 81133 81134, 81135
Dokis		
Dundonald *	OFR 5681	
Egan		81124, 81137
Elliott		81105, 81137
Frecheville		81136
Garrison		
Guibord		81119, 81120
Harker		81105, 81137
Hislop	GDIF 404 (3)	
Holloway		
Lamplugh		
Marriott		81136
McCann		
McCool	GDIF 380	
Michaud	GDIF 382	81114, 81118, 81119
Milligan		81112, 81113
Munro		
Playfair		81120
Rand		
Sheraton		81128, 81129
Stock	OFR 5674, GDIF 403	
Stoughton		81136
Tannahill		81136
Taylor		
Thackeray		81114
Thomas *		81129
Walker		81108, 81109
Warden	GDIF 381	81110, 81111, 81112
Wilkie		81104, 81106, 81107 81108
"Abitibi 1"		81137
"Abitibi 2"		81137
"Abitibi 3"		81136
"Abitibi 4"		81136

* not in BRiM.

(1) MP - Miscellaneous Paper (2) OFR - Open File Report
(3) GDIF - Geological Data Inventory Folio

formed during the past four years. This report will be compiled on a computer, in part in a data base format, and is expected to appear in 1989. Figure 13.5 and accompanying Tables 13.6 and 13.7 represent an updated version of the BRiM area precious and base-metal occurrence, deposit and mine compilation. These were assembled from the BRiM mineral occurrence data base base on which the final report will be based.

The Geological Data Inventory Folio (GDIF) component of BRiM was completed during 1987 and by early 1988, all (township) GDIFs pertaining to the area had been released. Figure 13.6 illustrates those GDIFs compiled as part of BRiM as well as their compilation dates (a measure of the individual GDIF timeliness).

As of late November 1988, about 56 600 m of core from 896 diamond drill and rotasonic overburden drillholes, representing more than 114 100 m of drilling in the BRiM area, had been catalogued and shelved, and were available for examination and sampling at the Kirkland Lake District and Porcupine Mining Division Drill Core Libraries.

RECOMMENDATIONS FOR EXPLORATION

A distinct, generally coincident, silver–gold–nickel anomaly was identified in a lake bottom survey performed by the Geological Survey of Canada (Hornbrook and Friske 1988) in the Bayly Township area. The lakes tested in this area are mainly underlain by the Coleman Member of the Gowganda Formation and are in close proximity to Archean volcanic rocks to the northwest. Although several silver, lead, copper and zinc showings were discovered in the past, it is unlikely that they would explain the strength and magnitude of the anomaly identified. Further exploration is required.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Detailed information on the following projects can be found in the Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141.

PRECAMBRIAN GEOLOGY SECTION

S.L. Jackson began a multi-year project studying the structure and stratigraphy of the Abitibi greenstone belt near Larder Lake.

D.S. O'Hanley of the Royal Ontario Museum investigated the cross fibre crysotile asbestos at the United Asbestos Deposit, Midlothian Township, in order to determine the usefulness of these fibres in indicating the stress fields related to major structures in the Abitibi greenstone belt.

A.R. Smith and R.H. Sutcliffe mapped the Abitibi batholith, the Otto Stock, and Ghost Range Sill in their study of plutonic rocks of the Abitibi Subprovince.

ENGINEERING AND TERRAIN GEOLOGY SECTION

P.W. Alcock mapped the quarternary geology in the Shining Tree area. The western parts of Montrose and Midlothian townships are included in this study.

GEOPHYSICS/GEOCHEMISTRY SECTION

An airborne electromagnetic and magnetic survey covering the Detour–Burntbush–Abitibi area was carried out by Geoterrex Ltd. of Ottawa under the direction of R.B. Barlow. The release of this data will be in the spring of 1989. This survey completes the coverage of the part of the Abitibi greenstone belt in the Kirkland Lake Resident Geologist's District, north of the Black River–Matheson area electromagnetic survey previously released in September 1984.

K.G. Steele directed a 52-hole sonic drilling program in the Black River–Matheson area during February and March 1988. During this program, 1698 m of drift and 103 m of bedrock were drilled.

RESEARCH BY OTHER AGENCIES

The Geological Survey of Canada published regional lake sediment and water geochemical reconnaissance data for the Gogama area (Hornbrook and Friske 1988).

UNIVERSITIES

Queen's University

M.B. McClenaghan, O.P. Lavin, I. Nichol, and J. Shaw: Quarternary Geology and Geochemical Exploration in the Matheson Area (McClenaghan *et al.* 1988).

W. Powell and C.J. Hodgson: Structural Expression of the Kirkland Lake–Larder Break near Matachewan.

University of Ottawa

K.D. Hicks and K. Hattori: Study of the Mineralization and Alteration of the Kirkland Lake Gold Camp – Implications for Hydrothermal Processes.

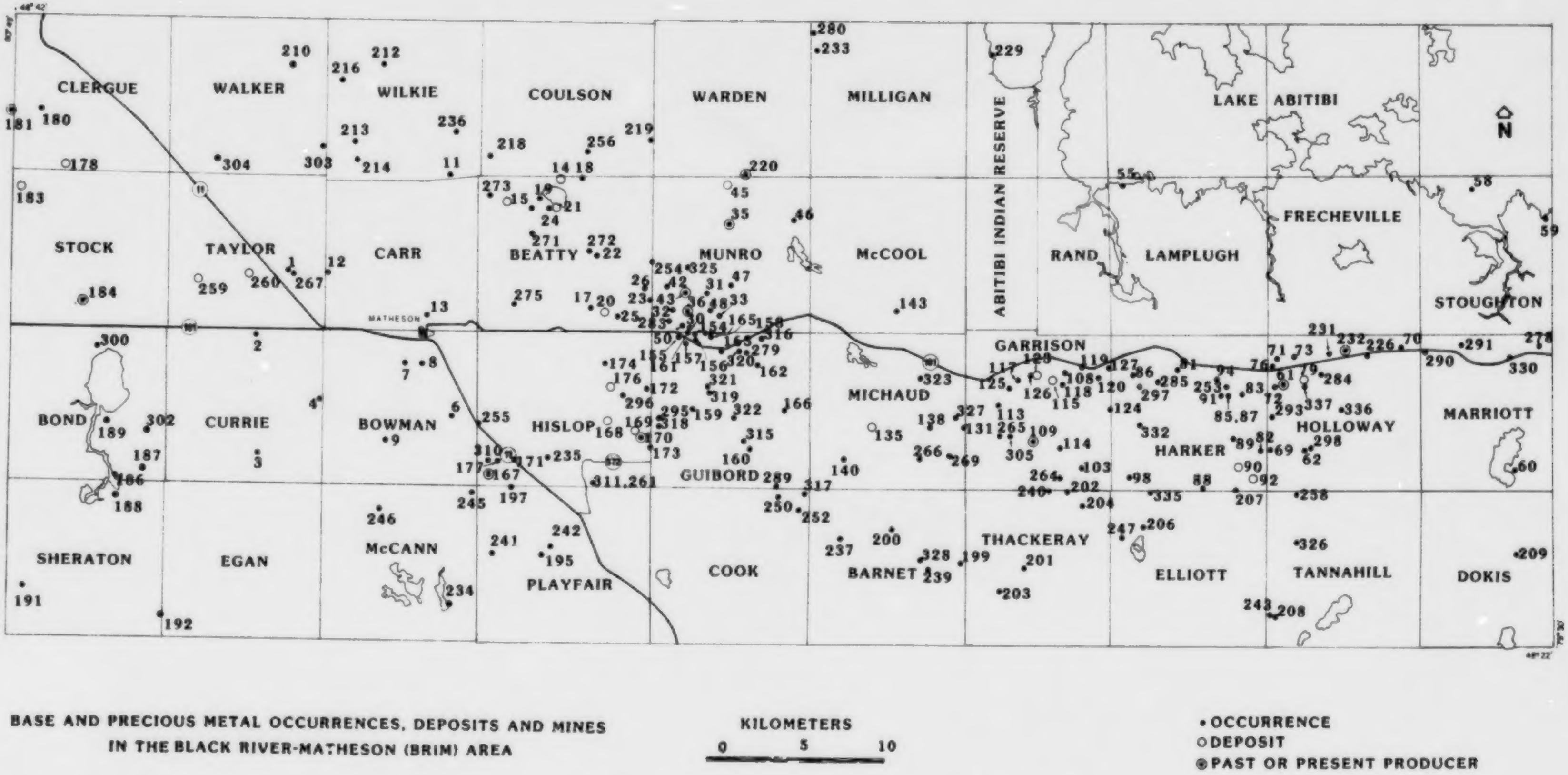
CLERGUE
WALKER
WILKIE
COULSON
WARDEN
MILLIGAN
ABITIBI INDIAN RESERVE
LAKE ABITIBI
FRECHEVILLE
STOUGHTON
N
STOCK
TAYLOR
CARR
BEATTY
MUNRO
McCOOL
RAND
LAMPLUGH
MATHESON
BOND
CURRIE
BOWMAN
HISLOP
GUIBORD
MICHAUD
GARRISON
HARKER
HOLLOWAY
MARRIOTT
SHERATON
EGAN
McCANN
PLAYFAIR
COOK
BARNET
THACKERAY
ELLIOTT
TANNAHILL
DOKIS
BASE AND PRECIOUS METAL OCCURRENCES, DEPOSITS AND MINES IN THE BLACK RIVER-MATHESON (BRIM) AREA
KILOMETERS
0
5
10
• OCCURRENCE
○ DEPOSIT
⊛ PAST OR PRESENT PRODUCER

Figure 13.5. *Precious and Base Metal Occurrences, Deposits and Mines in the BRiM Area. Map Numbers Used are Consistent With Those Used in Lovell et al. 1987 (Figure 7.4). For Index and Selected Support Documentation, see Tables 13.6 and 13.7.*

TABLE 13.6. SELECTED LIST OF NAMES, WITH COMMODITY TYPES, FOR SITES OF MINERALIZATION SHOWN ON FIGURE 13.5.

Number on Map	Name	Commodity
1	Turney Occurrence	Au
2	Anderson Occurrence	Au
3	Reid Occurrence	Au
4	Tillex Occurrence	Cu,Zn,Pb,Au,Ag
6	Sylvanite No.1 Occurrence	Au
7	Sylvanite No.2 Occurrence	Au
8	Sylvanite No.3 Occurrence	Au
9	Pollock-Briscoe Occurrence	Cu
11	Wilcarr Occurrence	Au
12	Watabeag Occurrence	Au
13	Black River Occurrence	Au
14	Aljo Deposit	Au
15	Maude Lake No. 5 Deposit	Au
17	Beatty Syndicate Occurrence	Au
18	Clifford Occurrence	Au
19	Lucky Ben Occurrence	Au
20	Stewart-Abate Deposit	Au
21	Blue Quartz Deposit	Au
22	Maude Lake Gold Mines Occurrence	Au
23	Denovo Occurrence	Au
24	Dunlop Occurrence	Au
25	Guinea Gold Mines Occurrence	Au
26	Pat Occurrence	Au
30	American Eagle Occurrence	Au
31	Big Game Occurrence	Au,Zn
32	Brown-Munro Gold Occurrence	Au
33	Buff-Munro Occurrence	Au
35	Potter Mine	Cu,Zn,Ag,Au
36	Croesus Mine	Au
42	Northern Goldbelt Occurrence	Au
43	Munro Mine	asbestos
45	Potterdoal Deposit	Cu,Zn,Ag,(Au)
46	Reoplata Occurrence	Au
47	Stewart Occurrence	Au
48	Walhart Occurrence	Au
50	White-Guyatt Occurrence	Au
55	Lamplugh Occurrence	Fe
58	Island 524 SV Occurrence	Au,Cu
59	Miller Occurrence	Au
60	Roy Occurrence	Au
61	Holt-McDermott Mine	Au
62	Howey-Cochenour-Willans Occurrence	Au
69	Taylor Horne Occurrence	Au
70	Mining Corp. East Group Occurrence	Fe
71	Mining Corp. North Group Occurrence	Au
72	O'Neill Occurrence	Au
73	Remo Occurrence	Au
76	Teddy Bear Occurrence	Au
79	Mattawasaga Deposit	Au
81	Graham-Bellingham Occurrence	Au
82	Meridian Occurence	Au
83	Consular Harker Occurrence	Au
85	Kerr Addison "Neal" Occurrence	Au
86	Dale Occurrence	Au,Fe
87	Demers Occurrence	Au
88	Harley Occurrence	Au
89	Harlight Occurrence	Au
90	Harker Gold Deposit	Au
91	Imperial Reserve Occurrence	Au
92	Iris Deposit	Au,W
94	Lightval Occurrence	Au

TABLE 13.6. CONTINUED.

Number on Map	Name	Commodity
98	Perrex Occurrence	Au
103	Bambi Occurrence	Au
108	Brydges Occurrence	Au
109	Buffonta Mine	Au
113	Garrison Creek Occurrence	Au
114	Garrison-Harbour Occurrence	Au
115	Garrcon Deposit	Au
117	Hastings Occurrence	Au
118	Inspiration Occurrence	Au
119	Linton Occurrence	Au
120	Mining Corp. No. 1 Occurrence	Au
123	Newfield Deposit	Au
124	Shunsby Occurrence	Au
125	Voge Occurrence	Au
126	Wright-Hargreaves Occurrence	Au
127	Thackeray Creek Occurrence	Fe
131	Caswell Occurrence	Au
135	Ludgate Lake Deposit	Au
138	Miller Occurrence	Au
140	Wright-Hargreaves Occurrences	Au
143	Bonnacord Occurrence	Au
154	Barlow-Dyer Occurrence	Au
155	Gold Pyramid Occurrence	Au
156	Big Pete Occurrence	Au
157	Bonter Occurrence	Au
158	Barrett Occurrence	Au
159	Caman Occurrence	Au
160	Gui-Por Occurrence	Au
161	Gold Coin Occurrence	Au
162	Cominco Occurrence	Au
163	Talisman Occurrence	Au
165	Eby Occurrence	Au
166	Morgan Creek Occurrence	Au
167	Canadian Arrow Mine	Au
168	Gunnar Deposit	Au
169	New Kelore Deposit	Au
170	Ross Mine	Au,Ag,Cu
171	Vimy Occurrence	Au
172	Hislop Mines Occurrence	Au
173	Edross Occurrence	Au
174	Abuy Occurrence	Au
176	Gibson West Deposit	Au
177	Weir Occurrence	Au
178	Montclerg Deposit	Au
180	Scott Occurrence	Cu,Zn,Ni
181	Alexo Mine	Ni,Cu
183	Clavos Deposit	Au
184	St. Andrew Goldfields Deposit	Au
186	Seaway Occurrence	Pb,Zn,Au
187	lot 2, con I, Bond Twp. Occurrence	Au
188	Roy Occurrence	Au
189	Consolidated Manitoba Occurrence	Au
191	Armont Occurrence	Au
192	Egan Occurrence	Fe
195	Mobb Occurrence	Au
197	Kakish-Ferguson Occurrence	Au
199	Dominion Gulf Occurrence	Au
200	Brett-Tretheway Occurrence	Au
201	Bibis Occurrence	Au
202	Garthack Occurrence	Au
203	Hewitt Occurrence	Au,Cu
204	Keevil Occurrence	Au

TABLE 13.6. CONTINUED.

Number on Map	Name	Commodity
206	Ghost Lake Occurrence	Au
207	Boulder Occurrence	Au
208	Jordan Occurrence	Au
209	Magusi River Explorations Occurrence	Cu
210	Hollinger Argus Occurrence	Cu
212	Hollinger "Esso Group" Occurrence	Au
213	Noranda Occurrence	Zn,Cu
214	Wilcarr Occurrence	Au
216	Mattagami Lake Exploration Occurrence	Au
218	Pit Occurrence	Au
219	Shallow River Occurrence	Au
220	Hedman Mine	Hedmanite
226	Neal Occurrence	Au
229	Claim Tp.43 Occurrence	Au
231	42 Zone Occurrence	Au
232	East Zone Mine	Au
233	Milligan Placer Train Occurrence	Au
234	Hyde Occurrence	Au
235	Gelinas Occurrence	Au
236	Fournier Occurrence	Au
237	Bonwitha Occurrence	Au
239	Noranda Occurrence	Au
240	Cortez Occurrence	Au
241	Temple Gold Occurrence	Au
242	Tremblay Occurrence	Au
245	Caramora Porcupine Occurrence	Au
246	Taylor Occurrence	Au
247	Randa Occurrence	Au
250	New Kelore Occurrence	Au
252	St. Joe Occurrence	Au
253	Trench Occurrence	Au
254	Mickle Occurrence	Ni
255	Potter-Quinn Occurrence	Au
256	lot 4, Concession I Occurrence	Au
258	Roy Occurrence	Au
259	Shoot Zone Deposit	Au
260	Porphyry Zone Deposit	Au
261	Hollinger Occurrence	Au
264	Kerr-Garrison Occurrence	Au
265	Consolidated Mining Occurrence	Au
266	Amax Occurrence	Au
267	Glen Auden/Adola Occurrence	Au
269	Nahanni Occurrence	Au
271	Salve Lake West Occurrence	Au
272	Salve Lake Occurrence	Au
273	Field Zone Occurrence	Au
275	Hollinger Occurrence	Au
278	Marriott-2 Occurrence	Au
279	Group II East Occurrence	Au
280	Kennco Occurrence	Au
283	Colossus Occurrence	Au
284	Canadian Nickel/Argentex Occurrence	Au
285	Sims Occurrence	Au
289	Prest Occurrence	Au
290	Marriott 1 Occurrence	Au
291	Dalhousie Occurrence	Au
293	Mary Ellen Occurrence	Au
295	Berrigan Occurrence	Au
296	Hiskerr Occurrence	Au
297	Shunsby Occurrence	Au
298	Coin Lake Occurrence	Au
300	Dome Occurrence	Au

TABLE 13.6. CONTINUED.

Number on Map	Name	Commodity
302	Westmin Occurrence	Au
303	Monpre Occurrence	Au
304	Surveymin Occurrence	Au
305	Winteroad Occurrence	Au
310	Heavens Occurrence	Au
311	Hollinger Occurrence	Au
315	Armco Occurrence	Au
316	Johns-Manville Occurrence	Au
317	St. Joe Occurrence	Au
318	Edross Occurrence	Au
319	Cameron Occurrence	Zn,Au
320	Hansen-McDonnell Occurrence	Au
321	Johns-Manville Occurrence	Au
322	Kerr Addison Occurrence	Au
323	Falconbridge Occurrence	Au
325	Lalonde Occurrence	Au
326	Gagne/St. Amant Occurrence	Cu,Au
327	Windjammer/Noranda Occurrence	Au
328	Glimmer Occurrence	Au
330	Neal Occurrence	Au
332	West Group Occurrence	Au
335	Discovery Mines Occurrence	Au
336	Lenora/Canadian Nickel Occurrence	Au
337	Canadian Nickel/Argentex Occurrence	Au

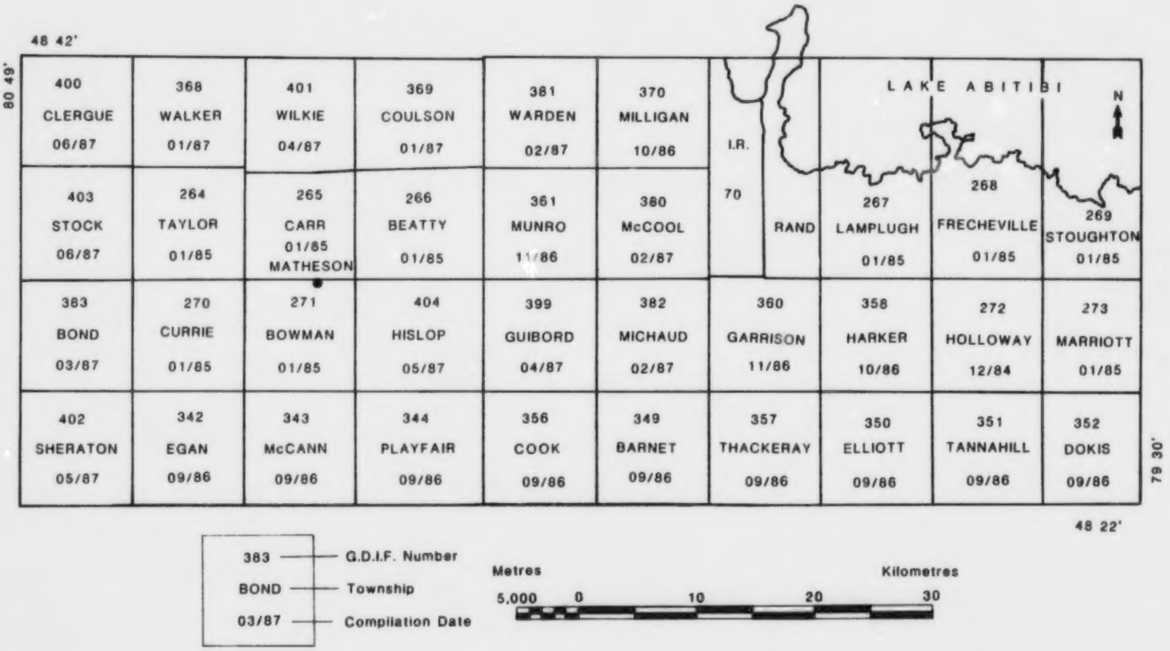
48 42'
80 49'
400 CLERGUE 06/87
368 WALKER 01/87
401 WILKIE 04/87
369 COULSON 01/87
381 WARDEN 02/87
370 MILLIGAN 10/86
I.R. 70
LAKE ABITIBI
N
403 STOCK 06/87
264 TAYLOR 01/85
265 CARR 01/85
MATHESON
266 BEATTY 01/85
361 MUNRO 11/86
380 McCOOL 02/87
RAND
267 LAMPLUGH 01/85
268 FRECHEVILLE 01/85
269 STOUGHTON 01/85
383 BOND 03/87
270 CURRIE 01/85
271 BOWMAN 01/85
404 HISLOP 05/87
399 GUIBORD 04/87
382 MICHAUD 02/87
360 GARRISON 11/86
358 HARKER 10/86
272 HOLLOWAY 12/84
273 MARRIOTT 01/85
402 SHERATON 05/87
342 EGAN 09/86
343 McCANN 09/86
344 PLAYFAIR 09/86
356 COOK 09/86
349 BARNET 09/86
357 THACKERAY 09/86
350 ELLIOTT 09/86
351 TANNAHILL 09/86
352 DOKIS 09/86
79 30'
48 22'
383 G.D.I.F. Number
BOND Township
03/87 Compilation Date
Metres
Kilometres
5,000
0
10
20
30

Figure 13.6. *Township Geological Data Inventory Folio (GDIF) (Numbers and Dates up to which the Folios are Current).*

TABLE 13.7. DESCRIPTIONS OF SELECTED ADVANCED EXPLORATION AND DEVELOPMENT PROJECTS IN THE BRIM AREA.

Number	Name	Commodity	Status	Reserves
14	ALJO DEPOSIT	Au	Underground exploration amounting to more than 6300 feet of drifting, more than 3500 feet of crosscutting and more than 450 feet of raising on 5 levels above and including the 650-foot level was completed before 1940 by Beatty Gold Mines Ltd., Hattie Gold Mines Ltd., Coulson Consolidated Gold Mines Ltd. and Devon Gold Mines Ltd.	In 1940, Devon Gold milled 2333 tons and produced 42 ounces of gold and 5 ounces of silver. Current reserves are not known.
15	MAUDE LAKE NO.5 DEPOSIT	Au	135 000 feet of surface diamond drilling, 234 000 cubic yards of overburden stripping and 16 800 tons of bulk sampling have been completed by Maude Lake Gold Mines Ltd., Freeport-McMoran Gold Co., Equinox Resources Ltd. and Technigen Corp. Underground exploration via an 833m long decline ramp during 1987-1988 included 661m of drifting, 200m of raising, 453m of additional lateral work and 4596m of underground diamond drilling.	Reserves of about 1 million tons averaging 0.204 ounce of gold per ton had been estimated prior to initiation of underground exploration. A mining feasibility study is in progress.
20	STEWART-ABATE DEPOSIT	Au	Stewart-Abate Gold Mines Ltd. sank a 122-foot inclined shaft and completed 210 feet of lateral exploration work on the 65-foot level prior to 1942.	No reserves have been reported.
21	BLUE QUARTZ DEPOSIT	Au	Prior to 1940, Cartwright Gold Fields Ltd., Blue Quartz Gold Mines Ltd. and Amalgamated Goldfields Corp. Ltd. completed about 750 feet of shaft and winze sinking, and about 11 000 feet of lateral exploration work on 5 levels above and including the 750-foot level.	Reserve estimates ranging from 109 000 tons averaging 0.484 ounce of gold per ton to 128 000 tons averaging 0.857 ounce of gold per ton have been made.
35	POTTER MINE	Cu,Zn,Ag	Mined out via underground mining by Centre Hill Mines Ltd., Munro Copper Mines Ltd. and the Pattrick Harrison Co. Ltd.	During 1967-1972, 477 572 tons were milled at an average grade of 1.63% Cu, 1.5% Zn, 0.1-0.5 ounce of silver per ton.
36	CROESUS MINE	Au	Mined out via undergroung mining by the Dominion Reduction Co., Croesus Gold Mines Ltd., Munro Croesus Gold Mines, Munro Croesus Mines Ltd. and Tellaurum Gold Mines Ltd.	The Croesus Mine represents a type example of high grade, low tonnage gold deposit. 14 859 ounces of gold and 1423 ounces of silver were recovered from 5333 tons of milled ore during the period 1915-1948.
43	MUNRO MINE	Asbestos	Mined out via both underground and open pit mining by Canadian Johns-Manville Co. Ltd.	During the period 1950-1964, 7 733 000 tons were mined, 7 723 000 tons were milled, 356 030 tons of asbestos worth $57 234 000 were shipped.
45	POTTERDOAL DEPOSIT	Cu,Zn, Ag,Au	Potterdoal Mines Ltd. mined from underground via a 125-foot inclined shaft 25 tons of massive sulfide ore averaging 15.22%Cu, 4.15%Zn 2.70 ounce of silver per ton and 0.045 ounce of gold per ton in 1927 and in 1930 mined from underground via a 115-foot vertical shaft 1413 tons which yielded 0.48% recoverable copper and 0.129 ounce of recoverable silver per ton.	No reserve figures are available.

TABLE 13.7. CONTINUED.

Number	Name	Commodity	Status	Reserves
61	HOLT-McDERMOTT MINE	Au	American Barrick Resources Corp. spent about $78 million bringing this gold mine and 1500 tonne per day mill complex into production in 1988. Underground mining is proceeding via a 420m 3-compartment shaft with 6 levels opened above and including the 350m level. A haulageway now accesses that part of the gold deposit which occurs on the Three Star and Worvest properties, held jointly with Lenora Explorations Ltd.	In August, 1988, reserves at the Holt-McDermott Mine, Three Star and Worvest properties were reported to be 4 million tons of proven and probable reserves averaging 0.152 ounce of gold per ton. Through the end of September, 1988, 105 696 tonnes averaging 3.5 gram of gold had been milled and 11 859 ounces of gold had been produced. Although variable, the gold:silver ratio at the mine is reported to be about 10:1.
79	MATTAWASAGA DEPOSIT	Au	Formerly held and surface diamond drill delineated by Canamax Resources Inc., American Barrick Resources Inc. recently agreed in principle to purchase 6 claims on which this deposit is located. The Mattawasaga Deposit is located several hundred metres east of the American Barrick Resources Holt McDermott Mine.	Drill-indicated reserves delineated by Canamax Resources are 1.6 million tonnes averaging 4.2 gram of gold per ton.
90	HARKER DEPOSIT	Au	Harker Gold Mines Ltd. sank a vertical 1050-foot 2 compartment shaft and completed several thousand feet of lateral exploration work on the 125-, 250-, 375-, 500- and 1000-foot levels prior to 1930. During 1987-1988, Lenora Explorations Ltd. ramped to the 500-foot level, established access to the old workings, completed over 2000 feet of underground lateral exploration, 125 feet of raising and stockpiled about 16 000 tons of auriferous material on surface.	Reserves of 500 000 tons averaging 0.16 ounce of gold per ton have been delineated.
92	IRIS DEPOSIT	Au,W	During 1987-1988, Perrex Resources Inc. and Alberta Gold Exploration Corp. completed diamond drilling, mechanical overburden stripping and completed a 500-foot long ramp to bulk sample gold-tungsten (as scheelite) mineralization within an albite syenite intrusive. An open pit mining feasibility study has been initiated, bulk sampling results are pending.	During 1987-1988, Perrex Resources 780 000 tons of material averaging 0.11 ounce of gold per ton have been drill-defined. The bulk sampling program is designed to establish a reliable tungsten tenor in addition to bulk metallurgical properties of the mineralized zone.
109	BUFFONTA MINE	Au	Amca Mines Ltd., Buffonta Mines Ltd., Siscoe Gold Mines Ltd. and Thorncliffe Mines Ltd. mined via underground workings and open pit a limited amount of material which produced gold during 1937-1962. From 1981-1982 Kerr-Addison Mines Ltd. mined via open pit about 70 000 tons averaging about 0.12 ounce of gold per ton. From 1986-1988, Silverside Resources Inc., Proteus Resources Inc., Lac Minerals Ltd. and Perrex Resources Ltd. performed geophysical surveys and surface diamond drilling.	Drill-indicated reserves of 410 000 tons averaging 0.17 ounce of gold per ton, have been delineated in the Nos. 5 and 6 Zones (east of the open pit) and reserves of 200 000 tons averaging 0.19 ounce of gold per ton west of the Nos. 5 and 6 Zones (in the open pit area) have been reported.

TABLE 13.7. CONTINUED.

Number	Name	Commodity	Status	Reserves
115	GARRCON DEPOSIT	Au	From 1935-1936, Consolidated Mining and Smelting Co. of Canada Ltd. and Garrcon Mines Ltd. sank a 260-foot inclined shaft and completed about 4300 feet of lateral exploration on the 120 and 240-foot levels. From 1985-1988, Jonpol Explorations Ltd. and Cominco Ltd. completed geophysical and surface diamond drilling programs. Jonpol acquired a 100% interest in the property in 1988 and, late in the year, Lac Minerals Ltd. acquired the right to earn an interest in the property.	Drill-indicated reserves in three zones, one of which is the old shaft area, are reported to be 350 900 tons averaging 0.19 ounce of gold per ton.
123	NEWFIELD DEPOSIT	Au	During 1987-1988, T & H Resources Ltd., Jonpol Explorations Ltd. and Coastoro Resources Ltd. completed 136 surface diamond-drill holes totalling 132 697 feet. Lac Minerals Ltd. acquired the right to earn an interest in the property late in 1988.	Drill-indicated reserves of 997 500 tons averaging 0.235 ounce of gold per ton have been delineated in 2 zones.
135	LUDGATE LAKE DEPOSIT	Au	During 1946-1947, Hoyle Mining Co. Ltd. established the presence of anomalous gold mineralization by diamond drilling 24 holes totalling 15 600 feet. Garrison Creek Consolidated Gold Mines Ltd. acquired the property via amalgamation and, during 1979-1988, Falconbridge Nickel Mines Ltd. and, Falconbridge Ltd. performed extensive surface drilling.	Drill-indicated reserves of 1 million tons averaging 0.09 ounce of gold per ton have been delineated.
167	CANADIAN ARROW MINE	Au	Golden Arrow Mines Ltd., Consolidated Golden Arrow Mines Ltd. and Canadian Arrow Mines Ltd. conducted surface and underground exploration during the period 1934-1972. Pamour Porcupine Mines Ltd. bulk sampled material derived in part from underground during 1974-1975. Pamour acquired a 20 year lease in 1980 and mined about 279 000 tons from an open pit and surface stockpiles. 17 045 ounces of gold were produced from the property.	Reserve figures are not available.
168	GUNNAR DEPOSIT	Au	During the period 1946-1980, Gunnar Gold Mines Ltd., Gunnar Mines Ltd., Gunnar Mining Ltd., Barymin Explorations Ltd. and Pancontinental Mining (Canada) Ltd. conducted exploration programs. By 1974, the presence of significant gold mineralization had been established, and by 1980 (?) reserves of 102 500 tons averaging 0.17 ounce of gold per ton had been drill-defined. From 1984-1988 Stroud Resources Canada Ltd. and Chevron Resources Canada Ltd. continued to explore the property.	By 1988, drill-defined reserves of 400 000 tons averaging 0.20 ounce of gold per ton have been delineated in the Creek Zone, one of at least 2 known auriferous zones on the property.

TABLE 13.7. CONTINUED.

Number	Name	Commodity	Status	Reserves
169	NEW KELORE DEPOSIT	Au,(Mo)	From 1934-1953, McIntyre-Porcupine Mines Ltd., Vin Dur Porcupine Gold Mines Ltd., Torovic Gold Mines Ltd., Kelrowe Gold Mines Ltd., Kelwren Gold Mines Ltd. and Kelore Mines Ltd. completed surface exploration and about 4900 feet of lateral underground work on 4 levels via a 475-foot vertical shaft. New Kelore Mines Ltd. acquired the property in 1953. From 1973-1983 Hollinger Mines Ltd. completed surface and underground exploration and delineated 400 000 tons of material averaging 0.17 ounce of gold per ton. During 1986-1988 Goldpost Resources Inc. acquired an interest in the property and is currently exploring underground via 2 decline ramps.	Reserves of 619 000 tons averaging 0.19 ounce of gold per ton above the 450 foot level have been delineated and are currently being explored via decline ramps.
170	ROSS MINE	Au,Ag,Cu	Giant Yellowknife Mines Ltd. is the current owner of the Ross Mine, which has been in continuous production since 1936. Sine the inception of mining operations, more than 1 million ounces of gold, more than 1.68 ounces of silver and more than 3000 tons of copper have been recovered from about 7 200 000 tons of milled ore.	Reserves at the Ross Mine were recently (1988) reported to be about 1 435 000 tons averaging 0.118 ounce of gold per ton.
176	GIBSON WEST DEPOSIT	Au	From 1981-1984, Geddes Resources Ltd. and Armco Minerals Exploration Ltd. confirmed the presence of a gold deposit originally explored by Martin-Bird Gold Mines Ltd. in 1949. From 1986-1988, Golpost Resources Inc. completed underground exploration via a decline ramp.	Reserve figures for the Goldpost Resources Gibson West Deposit are not available.
178	MONTCLERG DEPOSIT	Au	During the period 1939-1966, Montclerg Mines Ltd., Newmont Mining Corp., Anglo Huronion Ltd., Howey Gold Mines Ltd. and Consolidated Montclerg Mines Ltd. diamond drilled 80 holes totalling more than 46 000 feet from surface.	Drill-indicated reserves of 370 000 tons averaging 0.132 ounce of gold per ton have been delineated.
181	ALEXO MINE	Ni,Cu	From 1912-1919, the Alexo Mining Co. Ltd. and, from 1943-1944, the Harlin Nickel Mines Ltd. produced 2236 tons of nickel and 404 tons of copper from 56 780 tons of ore mined from underground.	The Alexo Mine was mined out in 1944; current reserves are not known.
183	CLAVOS DEPOSIT	Au	Canamax Resources Inc. diamond drilled more than 240 holes from surface to delineate 5 distinct auriferous zones along about 4.5 km of strike. Canamax and Bruneau Mining Corp. are currently preparing to sink an exploration shaft.	Diamond drilling by Canamax has delineated reserves of 1.16 million tons averaging 0.15 ounce of gold per ton or 643 500 tons averaging 0.22 ounce of gold per ton.
184	ST. ANDREW GOLDFIELDS MINE	Au	From 1972-1988, Quebec Sturgeon River Mines Ltd. and St. Andrew Goldfields Ltd. conducted surface exploration and underground exploration and on 5 levels and several sublevels above and including the 575-foot level via a 665-foot vertical shaft. In 1987, a production decision was announced and a 500 ton per day milling complex is under construction.	Reserves of 1.5 million tons averaging 0.186 ounce of gold per ton in 5 zones were been delineated by mid 1988.

TABLE 13.7. CONTINUED.

Number	Name	Commodity	Status	Reserves
220	HEDMAN MINE	Hedmanite	Hedman Resources Ltd. (formerly Hedman Mines Ltd.) has produced Hedmanite lizardite mineral filler from its openpit operation in Warden Township and from pilot and production mills in Matheson since 1963.	Drill-defined reserves were estimated in 1961 to be more than 8.3 million tons locally averaging as much as 15.6% lizardite filler content.
232	EAST ZONE DEPOSIT	Au	From 1984-1987, Canamax Resources Inc. and Procan Exploration Co. completed surface diamond drilling. Canamax purchased Procan's interest in the property in 1987 and initiated an underground exploration and bulk sampling program. In 1988, underground mining and exploration work continued via a decline ramp and shipping of stockpiled ore to the Cambior Inc. Vezina Mine mill, in Destor, commenced. Canamax anticipate producing 8000 and 21 000 ounces of gold from the deposit in 1988 and 1989, respectively.	Canamax has delineated 493 035 tons averaging 0.216 ounce of gold per ton in 2 zones.
259	SHOOT ZONE DEPOSIT	Au	During the period 1986-1988, St. Andrew Goldfields Ltd. and Esso Minerals Canada explored by surface diamond drilling a gold deposit delineated in 1972 by Labrador Mining and Exploration Co. Ltd. and Hollinger Mines Ltd.	Drill-defined reserves of 1.74 million tons averaging 0.13 ounce of hold per ton have been delineated by St. Andrews Goldfields Ltd. and Esso Minerals Canada.
260	PORPHYRY ZONE DEPOSIT	Au	During the period 1986-1988, St. Andrew Goldfields Ltd. and Esso Minerals Canada explored by surface diamond drilling and by underground exploration on 3 levels via a 565 565- foot deep 3-compartment shaft a gold deposit formerly delineated by Hollinger Mines Ltd., Labrador Mining and Exploration Co. Ltd. and Esso Minerals Canada.	Surface diamond drilling on the Porphyry Zone is reported to amount to more than 80 000 feet in more than 100 holes. Underground exploration on 3 levels and sublevels is in progress. No reserve figures have been released.

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14. Cobalt Resident Geologist's District—1988

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INTRODUCTION

In a complete reversal from 1987, when precious metals prices increased for the first time in five years, prices renewed their decline. This factor, combined with the stock market crash of October 1987 which dried up junior mine financing, and the impending demise of the existing flow through funding mechanism at the end of 1988, has resulted in a poor outlook for 1989. Although the exploration boom of the past year continued into the summer of 1988, the negative factors just described produced a significant drop in spending on exploration and development by year–end, and had resulted in a massive cutback in longer range spending plans announced by various companies last year. Although production and value of most commodities mined rose significantly for the second consecutive year, the trend is likely to reverse sharply in 1989, with the exhaustion of Agnico–Eagle Mines Limited ore reserves and that company's rationalization of operations, instituted in November 1988.

Some of the more important developments to take place during the year included: the purchase of Novamin Resources Incorporated's extensive Cobalt area land holdings and mines by Agnico–Eagle Mines Limited; the completion of the Penna shaft and the initiation of a major surface and underground exploration program in the Gowganda area, following the closure of the Castle Mine by this same company; and continuing expansion and development of area metallurgical limestone and dolostone deposits by a number of interested companies.

Major negative developments by year–end included suspension of exploration and indefinite closure at the following mines: Mann Mine, Pan Silver Mine, Tyranite Tailings Project, Lencourt Tailings Project, and Peterson Lake Decline; and indefinite suspension of mining at the formerly producing Castle Mine, Langis Mine, Hellens–Eplett Mine, and Beaver–Temiskaming Mine.

In addition, continuing restrictions on claim staking over much of the area, due to a long–standing land claim by the Bear Island Indian Band, remain in place. This claim has effectively stifled exploration for the past decade. A proposal put forward last year to create an extensive wilderness reserve between Gowganda and Temagami was resolved with the creation of a number of new waterway parks in the area. This proposal was entangled with the Indian land claim, plans to extend the Red Squirrel Road to reach timber, the impending closure of the Milne Lumber Mill, and various legal claims and road blockades.

Prices for most commodities mined in this area resumed their downward trend as silver declined by 13 percent to US$6.13 at the time of writing. As predicted last year, metal production continued to rebound, both in value and quantity, to the highest levels experienced in over two decades in this area. Approximately 1 443 221 ounces of silver, representing a 150 percent increase over last year, were produced from four area mines. Production levels are, however, predicted to decrease significantly in 1989 as all producing mines will be shut down by April 1989. Milling and refining operations will probably continue to mid–year. Iron pellet production decreased by 14 percent to 881 888 t because of a strike at the Sherman Mine, but metallurgical limestone production increased by 14 percent from the previous year to 175 000 t. In addition, 120 000 gallons of ferric sulphate were produced and shipped to various northern Ontario centres. Quarrying of two types of decorative building stone increased significantly to approximately 8000 tons. Substantial quantities of sand and gravel were also extracted. Cobalt, copper, and nickel were mined together with silver, but not recovered. The estimated total gross value of minerals extracted in the area during 1988 rose dramatically by 25 percent to approximately $70 million.

MINING ACTIVITY

AGNICO–EAGLE MINES LIMITED

Langis Mine

All mining and exploration was discontinued in the Langis No.3 Shaft area during the year. The shaft is, however, used to hoist ore and access the Langis No.6 Shaft workings, located approximately 0.7 km to the east. Although sufficient reserves were delineated in this area to continue mining for approximately an additional six–month period, all operations were suspended in the middle of November because of low silver prices. The mine will remain on a stand–by basis indefinitely.

TABLE 14.1. MAPS AND REPORTS PERTAINING TO THE COBALT RESIDENT GEOLOGIST'S DISTRICT PUBLISHED DURING THIS YEAR BY THE ONTARIO GEOLOGICAL SURVEY, MINISTRY OF NORTHERN DEVELOPMENT AND MINES.

Ontario Geological Survey Reports

Open File Reports
OFR 5663
OFR 5667

Preliminary Maps - Geological Series
P.3115
P.3115

Geological Data Inventory Folios
GDIF 425
GDIF 435
GDIF 436
GDIF 437
GDIF 445
GDIF 446
GDIF 447

Coloured Maps
2205 (reprint)

Mineral Development and Lands Branch Publications
MPBP 25
IMBP 7
IMBP 8

Miscellaneous Reports
MP 97 (reprint)
MP 110 (reprint)
MP 138
MP 139

Mineral Deposits Circulars
MDC 13 (reprint)
MDC 17 (reprint)
MDC 18 (reprint)

Geological Survey of Canada Publications
OF 1639
OF 1640
OFR 1440
Map NL-17-GR(BA)

Mining and exploration continued without interruption to the middle of November 1988 in the No.6 Shaft area. The most significant development included 122 m of crosscutting and minor raising on the 335-foot level and 122 m of crosscutting on the 400-foot level. This work was initiated to check promising silver intersections obtained from earlier diamond drilling.

Extensive underground diamond drilling continued, primarily to test areas southeast of the present No.6 Shaft workings. Some fill-in drilling over known ore veins was also completed. Total footage drilled during the year decreased significantly by 37 percent to 5375 m.

Production decreased to 8889 tons during the year, which represents a drop of seven percent from 1987. Average grades were similar to last years, resulting in a corresponding six percent drop in contained silver to approximately 139 800 ounces. All the ore was obtained from eight veins. Of these, the No.55, No.58, and No.112 were mined out and completely pulled, and provided 15 percent of the ore and 16 percent of the silver. The three most significant veins contributing to production were mined out in the past, but remaining broken ore comprised much of this year's production. Of these, the No.110 was once again the most prolific, providing 28 percent of the ore and 32 percent of the silver. The No.53 vein provided 34 percent of the ore and an almost equal 30 percent of the silver, and the No.54 vein provided 15 percent of the ore and 15 percent of the silver. The remainder of the ore was obtained from the No.56 and No.57 veins, which still contain mineable reserves. In addition, two new veins, the No.116 and No.117, have yet to be mined and a number of untested promising veins remain as future potential.

Castle Mine

This mine, located in the Gowganda area, continued operations to the end of June 1988, at which time ore was exhausted and the mine was closed. Both track and pipe were salvaged from all levels, except the fourth and sixth which remain to provide access for a company with neighbouring claims which has an option to use the mine facilities. The mine was allowed to flood up to the sixth level.

Despite the early closure of the mine, production for the year only declined by 13 percent from last year to 4522 tons. However, because of higher grades, the amount of silver contained in this ore rose by 21 percent to 74 976 ounces.

Underground exploration continued at a relatively high rate in an effort to find new reserves, but was unsuccessful. Total footage drilled amounted to 4200 m. Development, as a result, was fairly limited and amounted to 83 m of drifting, subdrifting and crosscutting, and 63 m of raising. The majority of this work was within the Nipissing diabase above the 6th level. Minor drilling also investigated the lower contact with Keewatin metavolcanic rocks on lower levels.

The majority of the ore mined (45 percent) was obtained from the No.5003 vein on the fourth level, which provided 74 percent of the silver. The remainder of the ore and silver originated from the No.1904 and No.1905 veins on the second level; the No.5007 vein on the third level; the No.0101 vein on the fourth level; and the No.0101 and No.2303 on the sixth level.

Beaver-Temiskaming Mine

Although exploration continued at a similar pace to the past few years, mining activities continued to decline as ore reserves were exhausted. In the middle of November, all exploration and mining operations were terminated as the company rationalized its operations. Approximately four months of broken ore remain in stopes and will be pulled during the winter. The future of this operation is in doubt beyond March 1989.

The bulk of mining was once again concentrated in the Cobalt Lode area, where approximately 326 073 ounces of silver were recovered from 11 672 tons of ore. In the Brady Lake area, 1754 tons of relatively low grade ore were mined to provide an additional 7857 ounces of silver. In total, production decreased by 6 percent to 13 426 tons, while ounces of silver recovered increased by 34 percent to 333 925 ounces.

Fifty percent of the ore and 64 percent of the silver were obtained from above the 1330-foot level on the No.37 vein system. The bulk of this was mined from the northern end of the vein in 1987-88, while the remainder was pulled from the southern end which had been mined in 1986-87. The No.41 vein, which had been mined out in 1986, provided 11 percent of the ore and 9 percent of the silver, while the No.38 vein, mined during the year, supplied 6 percent of the ore and 10 percent of the silver. The remainder of the ore and silver were obtained from four small veins, the No.51, No.52, No.53, and No.56 veins above the 1330-foot level and a small remnant, the No.04 (actually the No.01) vein above the 1600-foot level. All of these veins are located in the Cobalt Lode area. Material mined in the Brady Lake area to the northwest accounted for only 13 percent of the ore and 2 percent of the silver.

Only minor development work was completed in the Cobalt Lode area (south mine workings) from the 1600-foot level. Drifting of 24 m on the No.04 vein (No.01) was completed, and a 45 m raise put up to assist mining of a small high grade pocket of silver ore. The remainder of development work took place in the Brady Lake area to the northwest. In 1987, a new crosscut was started on the 1330-foot level and advanced a distance of 407 m to the northwest. In 1988, it was extended farther to access the No.63 vein. A total of 784 m of development work was completed. This figure includes minor drifting on the No.64, No.63, and No.68 veins on this level. In addition, 8 m of raising was completed on the No.64 vein. Of these veins, only the No.64 contained minor silver and erratic cobalt mineralization. The level itself is primarily within Keewatin mafic metavolcanic flows and interflow sediments, immediately below the lower contact of a Nipissing diabase sill. In this same area, a raise was put up from the 1450-foot sublevel to the 1330-foot level on the No.60 vein (lower extension of the No.63 vein). The raise was put in to test promising silver values observed on the drift level and to provide an ore pass.

Underground exploration diamond drilling declined for the fourth consecutive year, by 4 percent, to 6597 m. Exploration was spread relatively equally between three areas of interest. Drilling west of the Brady Lake area failed to find any new significant intersections, while new drilling on the Christopher claim to the south returned a single ore-grade value. The remainder of the drilling tested the Beaver claim, north of the Temiskaming shaft.

All stopes have been developed in veins cutting Archean mafic metavolcanic flows below a significant step-like structure formed at the lower contact of a Nipissing diabase sill (Robinson 1984). During the year, most of the ore was obtained from those parts of the veins cutting the metavolcanic rocks, although ore does persist up into the diabase, in some instances to 15 m. Any future exploration at this mine would probably involve drifting and crosscutting to the north of the Brady Lake area, possibly to eventually link up with proposed exploration crosscuts from the Conisil Mine, located approximately 750 m to the north.

DOFASCO INCORPORATED-TETAPAGA MINING COMPANY LIMITED

Sherman Mine

After steadily increasing production over the past several years while recovering from the recession of the first part of this decade, this mining operation encountered labour problems in 1988. Both the mine and plant were closed, because of a strike, for a 31-day period extending from March 26 through April 26. In addition, operations were suspended for a three-week period in late summer for vacation, a policy instituted seven years ago. As a direct result, production levels decreased by 14 percent to 881 888 t of iron pellets, recovered from 3.43 million t of crude ore. At the same time, mining of waste decreased by 25 percent to 2.03 million t. The stripping ratio at the mine during the year was at 0.59. This is the first time in many years that the mine has not maintained a minimum annual production in excess of 1 million t of pellets.

Production continues to decline at the main East Pit, which contributed 43 percent of the ore during the year, as development of the Turtle Lake Pit accelerates. This latter pit now provides 21 percent of the output. Ore produced at the West Pit increased and provided 35 percent of the production in 1988. The South Pit was completely mined out by the end of 1987 and is no longer active.

During 1988, mining of the third bench at the East Pit was completed and the fourth bench started at the eastern end of the pit. At the West Pit, all stripping was completed as was mining of the extreme western end of the pit. All development is now concentrated at the main centre portion of the pit, which continues to be deepened. The development of the Turtle Lake Pit is now progressing at two separate locations which will eventually merge. A three bench sink has been completed at the western end of the deposit, while a first bench has been advanced at the southeastern end.

A research project, initiated in 1987 to evaluate the use of waste carbon as a potential additive in the pelletizing process, ran into unexpected problems during the year. Apparently, coal dust from Dofasco was to be used in the experiments, but arrived as large, solid, rock–like agglomerations. As a result, little actual work was undertaken in 1988, although plans remain to carry out some testing in 1989.

HELLENS–EPLETT MINING INCORPORATED

Hellens–Eplett Mine

This mine, seven years in the making since exploration initially began in 1981, finally achieved production status, only to announce full closure by November 1988. A combination of poor silver prices, recovery problems at the mill, low reserves, and excessive custom milling and refining costs contributed to the decision to suspend operations indefinitely.

Both development and underground exploration diamond drilling continued throughout much of the year toward the goal of establishing production. Underground exploration diamond drilling continued at a modest rate, but declined for the second consecutive year, by 17 percent to 4649 m. During this program, two new veins, the No.6 and No.7, were discovered. One of these returned high–grade silver values, while the other, although a promising structure, was comprised mainly of sulphide mineralization with minor silver values. Neither of these veins were tested with follow–up work and remain as good potential targets for the future. Extensive drilling from an exploration crosscut, advanced last year to the McKenzie Fault in the west mine workings, failed to find any potential ore structures in this area. Drifting along one of the ore veins did, however, uncover a heavily mineralized interflow band in the Keewatin mafic metavolcanic assemblage. The band carried excellent zinc values but widths and strike length were very inconsistent, a typical feature of these sediment bands elsewhere in the camp. A number of representatives from major base–metal mining companies were provided with tours of this occurrence.

During the year, the bulk of development was carried out on the No.4 vein system, where 163 m of drifting was completed on one of four sublevels. In addition to stoping of the vein, three raises totaling 110 m were completed. On the No.2 vein, two raises totaling 29 m were established and 31 m of drifting and crosscutting completed, as well as stoping of the vein. The No.1 and No.3 veins each had one raise, 14 m in length, established.

A small hoist was used intermittently until the end of September to raise both ore and waste, which was then stockpiled on surface. Production for the year totaled 2058 tons of ore, which yielded 43 221 ounces of silver. Only the No.1 vein has been completely mined out. The remaining mineral inventory of the deposit includes approximately 2300 tons of stockpiled ore on surface, grading 25 to 30 ounces of silver per ton. This material is scheduled for custom milling and refining at the local Agnico–Eagle Mines Limited facilities in the spring. No broken ore remains underground, but estimated reserves of all categories of *in–situ* material approximate 380 000 ounces of silver.

The portal has now been filled in to a depth of 15 m and a removable cap placed on the shaft. The mine will remain closed until silver prices reach a level conducive to economic recovery of the remaining ore.

DYMOND CLAY PRODUCTS LIMITED

Bucke Quarry

Both mining and exploration continued at an accelerated rate in 1988. The company expanded its mine property by approximately 300 acres by buying a number of lots adjoining its quarry. Two short drillholes were put down on this new ground to test the continuity of high–grade limestone beds presently being quarried.

The quarry pit itself was expanded during the year and now measures approximately 200 m by 200 m by 7 m deep. Ten holes were drilled near the quarry during the year in order to increase and verify pit reserves. The company had earlier run into problems with high K_2O values, caused primarily by contamination during the mining process. This problem has, in the most part, been rectified by applying more selective mining practices to the operation.

The quarry presently operates continuously throughout the year, although only crushing, loading, and trucking takes place during a period of four months in the winter. At present, flux material destined for the iron mines is crushed to gravel size on the pit floor and trucked directly to the mines where it is crushed to smaller sizes. Metallurgical grade material destined for Kidd Creek is first crushed to gravel size on the pit floor; the material is then transferred by loader to a drying furnace and subsequently by conveyor to a storage cone; from the cone, it is transferred by conveyor to a secondary crusher where it is reduced to powder and conveyed to a loading hopper.

Production increased by 14 percent from 1987 to approximately 175 000 t this year. Of this total, 75 percent was sold to the Sherman and Adams iron mines as flux limestone, 7 percent was metallurgical limestone sold to the Kidd Creek smelter, 18 percent was sold as aggregate and armourstone, and less than 1 percent was used as agricultural limestone.

In addition to the quarry operations, the company initiated an extensive exploration program to identify both limestone and dolostone deposits for other markets. On the basis of high–potential areas identified in a report generated by this office (Grant and Owsiacki 1987), three properties were optioned in three separate townships. Testing and evaluation were carried out and included diamond drilling of 20 short holes (average 15 m). Part of this program was partly funded through a Northern Ontario Regional Economic Development Program (NOR–DEV) agreement. The company also received funding through this vehicle to assist in a market and product development program.

G. BOUGHNER

McLaren's Bay Mica Stone Quarries

Quarrying of decorative building stone from this property totalled approximately 7500 tons in 1988. This represents a marked increase from the 200 tons produced in 1987. The quarry actually consists of a significant number of shallow pits stretching over several kilometres in McAuslan Township. The pits are mineralogically distinct, consisting of micaceous quartzites and muscovite schists, and reflect the two dominant rock types underlying the area. The various shades of red, green, and black stone have recently been in increasing demand from distributors in Toronto, Montreal, and the United States, a possible result of a construction boom in these areas. One buyer is also interested in grinding the muscovite schist and using it as an automobile paint additive. The property has produced only relatively small quantities of decorative stone since 1964.

P. PHARAND

Thorne Brilliant Stone Quarry

This company, based in Thorne, Ontario, produced approximately 500 tons of rough–cut building stone and flagstone from quarry operations in Poitras Township. The dominant product types include black gneiss and a variety of fissile mica schists. The stone is used locally, and may be seen on several buildings in Thorne and Temiscaming, Quebec.

MILLS AND REFINERIES

HELLENS–EPLETT MINING INCORPORATED

Hellens–Eplett Mill

Four mills are located within the Cobalt area, although only two were used during 1988. One of these, the Hellens–Eplett Mill, operated for only a six–month period before suspending operations. Both the mill and tailings containment area were completed early in the year. The mill, however, could only process 40 tons of ore per day instead of the designed 80 tons per day. In addition, recoveries were initially quite poor, although they improved to 92 percent by May. Low silver prices and lack of production ultimately forced suspension of the operation by the beginning of July. The mill is presently in place and operation–ready, but will likely be put up for sale in the near future.

AGNICO–EAGLE MINES LIMITED

Penn Mill

This mill operated continuously throughout the year, processing ore from the company's three producing silver mines. Throughput was at a rate of 270 to 280 tons per day, approximately 90 percent of design capacity. Early in the year, the tune–up stage of this new facility was successfully completed. In addition, roads bordering the Glen Lake tailings basin were raised to allow greater storage capacity. The company also continued an evaluation of the Nipissing tailings deposit for possible future recovery, and are currently completing an environmental impact study relating to the final discharge of their existing tailings effluent. Projects being considered for 1989 include the raising of the Glen Lake tailings dam, addition of a waterflow measuring system, clean out of a secondary polishing pond, waterproofing of embankments, and addition of a decant structure.

Agnico–Eagle Silver Refinery

This refinery also operated continuously throughout the year, processing concentrate from the company's mill as well as custom refining ore from the Hellens–Eplett Mill. In addition, the company purchased 174 072 pounds of slag from various sources, including Kidd Creek Mines Limited. This slag was processed at the Temiskaming Testing Laboratories to produce a lead–silver matte containing 59 180 pounds of lead and 12 023 ounces of silver. This matte was sent to the Brunswick Mining and Smelting Corporation Limited lead smelter in New Brunswick and the Noranda smelter in Noranda, Quebec, for further refining.

In addition, various research–oriented projects were undertaken. An earlier project, partly funded by a NOR–DEV grant last year (Owsiacki and Anderson 1987), was completed with promising results. Follow–up investigations will be continued by other interested companies into the feasibility of developing alternate extraction and refining processes. The Linde Division of Union Carbide Canada Limited carried out tests, at their cost, using oxygen, in an attempt to improve extraction rates. The results were encouraging enough for Agnico–Eagle Mines Limited to agree to an evaluation of the process at a full plant–scale test in 1989. Lakefield Research have also been involved with an evaluation of a process using a carbon recovery system on area silver concentrates at their southern Ontario plant. Inco was also retained to evaluate a sulphur dioxide process which might assist in cyanide destruction. Agnico–Eagle Mines Limited is also testing and evaluating different filter presses for their leach residue, which might reduce cyanide concentrations. These latter two projects are aimed at reducing cyanide levels to Ministry of Environment standards. The company is also actively trying to sell its 15 000 ton stockpile of leach residue, and hope to recover the contained silver and cobalt.

XIB RESOURCES

Cobalt Refinery

During the year, the exteriors of a two–story office building and one–story laboratory building were refurbished at the refinery site. In addition, the entire plant was cleaned of metallic scrap and approximately half of the existing copper–ferrous–arsenate dumps were cleaned up. Ten full–time employees are currently employed by the company, which plans to change its name back to Cobalt Refinery Limited in January 1989.

A copper extraction process, using cementation with an iron powder, proved to be uneconomical and was terminated in late 1987. As a result, no metallics were produced during the year. Some experimentation has recently been started using a copper ferrous solution and an electroplating process to recover ferric chloride and copper from secondary feedstocks.

The bulk of activity was focused on the production of ferric sulphate from ferrous sulphate crystals obtained from Sidbec Inc. in Montreal. This product is used as a sedimentation agent in sewage treatment plants. Approximately 120 000 gallons were produced during the year and sold in Thunder Bay, Sudbury, North Bay, Gatineau, and Hemlo. The company plans to automate this system in 1989.

ADVANCED EXPLORATION AND DEVELOPMENT

AGNICO-EAGLE MINES LIMITED

Penna Mine

The Penna Shaft, located approximately 1.5 km east of the Langis No.3 Shaft, was completed to a depth of 1182 feet in October 1988. The shaft sinking was finished slightly behind schedule due to heavy water flows related to major subhorizontal faults encountered at depth. The shaft, collared in Nipissing diabase, cut the lower contact of this sill at a depth of 176 feet and continued down through a thick sequence of Huronian Coleman Member laminated greywackes and conglomerates to a depth of 720 feet, where the unconformity with Keewatin mafic metavolcanic rocks was intersected. It is situated centrally within a possible Keewatin–age fault valley trending northeasterly. Potential vein systems may have developed over the two flanks of this paleostructure. Significant high–grade silver intersections have been recovered from within all three rock types at the western margin of this trough. This is the principle target for investigation.

During shaft sinking, 13 stations were cut at intervals of 72 feet, beginning at a depth of 276 feet. An ore pass was also established between the ninth and eighth levels, and a waste pass between the fifth and fourth levels. Crosscutting was initiated in November on the fourth and eighth levels. On the eighth level, it will be advanced a distance of 2400 feet at a bearing of 320°, to eventually reach the Langis No.6 Shaft area 300 feet below the existing levels. At the same time, a crosscut bearing 035° was started on the fourth level and will be advanced a similar distance of 2400 feet.

Leroy Shaft

Agnico–Eagle Mines Limited acquired the former Coleroy and Ottawa–Gowganda properties in Nicol Township and Haultain Township, respectively, as reserves at their nearby Castle Mine were exhausted. During the year, the company refurbished the existing Coleroy headframe and mine support buildings, and now refer to it as the Leroy Shaft. Dewatering of the workings is presently underway and will continue to the end of 1988 down to the 650–foot level. The company plans to drive two crosscuts to provide diamond–drill stations in early 1989, and during the summer of 1989 a new decline is planned to provide access to the Ottawa–Gowganda workings (D. Marek, Mine Geologist, Agnico–Eagle Mines Limited, personal communication, 1988).

The area is underlain by Keewatin–age intermediate to mafic metavolcanic rocks intruded by Matachewan diabase and Nipissing diabase. The shaft was originally sunk to the 650–foot level in 1927, and extensive lateral work was completed on a series of calcite veins hosting native silver, nickel and cobalt arsenides, pyrite, and chalcopyrite. No high–grade ore zones were encountered at that time, and the best values were obtained from the No.1 vein on the 488–foot level. There was little or no production reported. The geological setting is similar to the Castle Mine, with the entire Nipissing diabase sill preserved between metavolcanic rocks at surface and below the sill (McIlwaine 1970).

AGNICO-EAGLE MINES LIMITED-SILVER CENTURY EXPLORATIONS

Peterson Lake Decline

Mine support buildings were erected during the year at the portal site on the western shore of Peterson Lake, just east of the town of Cobalt. Driving of the decline was started in October 1988. By mid-November, the decline had been advanced a total distance of 147 m and two sumps and one drill station cut before the project was halted and indefinitely suspended because of lack of funds and low silver prices. This decline was intended purely as an exploration venture at this time, and was designed to provide exploration access below an unexplored portion of the Nipissing diabase sill.

TYRANEX GOLD INCORPORATED-GUNNAR GOLD INCORPORATED-MILL CITY GOLD INCORPORATED

Tyranite Mine

These three companies, joint owners of the Tyranite Mine in Tyrrell Township, completed rehabilitation of the main shaft and construction of a headframe and mine support buildings this year. The shaft was dewatered to the 1125-foot level, which was the deepest development of the former workings. Ground control problems were encountered on the old second and fourth levels. No lateral development was undertaken, although limited sampling and mapping was carried out on the 825-foot, 975-foot, and 1125-foot levels (S. Reimsbottom, Consulting Geologist, Gunnar Gold Incorporated, personal communication, 1988).

The Tyranite Mine produced 31 353 ounces of gold and 4860 ounces of silver from 223 810 tons of ore mined between 1939 and 1942 (Tremblay 1946). Current company estimates place reserves at 520 000 tons, averaging 0.2 ounce gold per ton between 825 feet and 1425 feet in the Main Zone. At the Duggan Zone, 2.4 km to the west, previous diamond drilling outlined the presence of a shallow zone containing material averaging 0.392 ounce gold per ton. An exploration portal has since been collared to a depth of 30.5 m in this zone.

Both areas are characterized by the presence of several intrusions of peridotite, now altered to serpentinite, within andesitic flows. Contacts between these two rock types have in turn been carbonatized and silicified. Associated shear zones are the favourable loci for gold mineralization, and extend for a distance of 1524 m at the Main Zone and 762 m at the Duggan Zone (Mill City Gold Incorporated 1988).

Exploration at the mine has been temporarily reduced while the companies seek additional financing to continue the project.

In addition to the mine exploration, the companies commissioned a feasibility study of the Tyranite tailings in 1987. Recoveries from the old Tyranite mill suggested that a grade of 0.034 ounce gold per ton might be expected. A small gravity separation tailings mill, containing six slime tables, was erected and 2000 tons of slurry processed. The recovery rate proved to be uneconomical and the project was cancelled earlier this year (S. Reimsbottom, Consulting Geologist, Gunnar Gold Incorporated, personal communication, 1988).

MANRIDGE EXPLORATIONS LIMITED

Mann Mine

This company extended a decline, started in 1984, by 182.9 m to the 1200-foot level at the Mann Mine in Milner Township. A further 91.4 m of crosscutting, 4.6 m of raising, and 670.6 m of underground diamond drilling were completed on the D Zone to test known silver-bearing vein structures (A. Parcher, Project Manager, Manridge Explorations Limited, personal communication, 1988). Results of this program failed to define any significant new ore reserves, as silver mineralization was found to be erratic. The project has since been terminated due to insufficient funds and current low metal prices. The mining equipment has been put up for sale.

Native silver was first discovered at this site in 1909 in a 12.7 cm wide quartz-calcite vein, hosted entirely within Nipissing diabase. Production at this time, from five shallow shafts, totaled 98 822 ounces of silver from 68 tons of ore and concentrate and 20 150 ounces of silver from 3094 tons of tailings (Sergiades 1968).

SANDY K MINES LIMITED

Upper Bonsall Mine

Derry, Mitchener, Booth & Wahl, consultants to Sandy K Mines Limited, continued underground exploration of the former Upper Bonsall Mine near Gowganda. Previous production from both the Upper Bonsall Mine and Lower Bonsall Mine amounted to 256 383 ounces of silver contained in 10 114 tons of ore (Sergiades 1968). In 1987, Sandy K Mines Limited refurbished an existing adit, and in February 1988 completed 152.4 m of drifting, 33.5 m of raising, and 6096 m of underground diamond drilling to investigate known areas of silver mineralization. Although results were encouraging, operations were subsequently suspended while negotiations were initiated to arrange the merger of Sandy K Mines Limited and NLX Resources Incorporated, in an effort to increase exploration financing. To date, this merger has not been completed. In November 1988, the company started a 1219 m underground drilling program to test vein structures, and completed 61 m of additional drifting. Office and maintenance facilities are being rented at the nearby Agnico-Eagle Mines Limited Castle Mine (J. Mayer, Derry, Mitchener, Booth & Wahl, Geologist, personal communication, 1988).

Earlier in the year, Lencourt Limited failed to reach a royalty agreement with Sandy K Mines Limited on the Siscoe Mill silver tailings retreatment project in Gowganda. A feasibility study completed by Kilborn Limited in 1987 outlined the presence of 1.8 million tons of tailings with an average grade of 1.42 ounces of silver per ton. The project was intended to process tailings at a rate of 225 000 tons annually over a lifetime of seven years. Recoveries of 87 percent were expected using a simple process involving grinding, cyanide leaching, zinc precipitation, and refining (Owsiacki and Anderson 1988). A Lencourt Limited press release subsequently announced the termination of the project because of low silver prices.

NOVAMIN RESOURCES INCORPORATED-CANACORD RESOURCES INCORPORATED

Conisil Mine

These companies continued an underground exploration program of drifting and raising along previously identified silver veins on the 310-foot level and 535-foot level of the Conisil Mine (Owsiacki and Anderson 1988). Although significant reserves were established during 12 months of exploration, the program was prematurely terminated at the end of January 1988. At the time, two raises above the 310-foot level on the No.2 vein and an exploration drift heading on the No.78 vein were in high-grade silver ore.

In July 1988, Agnico-Eagle Mines Limited entered into an agreement with Novamin Resources Incorporated to purchase all the latter company's Cobalt area properties, leases, and mines. Since this time, Agnico-Eagle Mines Limited has been evaluating all previous work and formulating plans for an exploration program in 1989.

The Canadaka Mill will be dismantled and sold by brokers for Novamin Resources Incorporated if no buyer is found during the winter. This company, now a subsidiary of Breakwater Resources Limited, will retain the surface rights to the immediate mill area. Agnico-Eagle Mines Limited is currently processing silver-rich residue obtained from the mill, and plans to initiate a crosscutting and drifting exploration program in early 1989.

JASCAN RESOURCES INCORPORATED

Pan Silver Mine

Exploration and development at this mine continued until March 20, 1988, at which time the pumps were pulled and operations indefinitely suspended. Although significant silver reserves were established, low silver prices and excessive custom milling costs resulted in termination of the project. The project, managed by A.C.A. Howe International Limited, employed 36 miners over a 14-month period and cost approximately $2.5 million.

Since December 1987, exploration drilling, drifting, and raising had continued on three levels at the mine. On the 190-foot level, development was restricted to 40 m of drifting along the previously untested No.27 vein, which was originally crosscut by PanContinental Mining Limited. A short shoot (10 m) of ore-grade material was outlined, but a 20 m raise subsequently showed the mineralization to be inconsistent. The bulk of exploration on this level consisted of drilling long exploration holes to test the southern end of the area.

Much of the development on the 240-foot level involved raising to test continuity of silver values encountered during earlier drifting on veins. One 15 m raise was put up on the No.27 vein, six 6 m raises on the No.24 vein, and five 6 m raises on the No.28 vein. In addition, test drilling above a previously known vein structure, the No.22, which closely paralleled the major producing No.1 vein, revealed interesting silver values. As a follow-up, a subdrift was established 6 m above the level and extended 6 m north and 15 m south along the No.22 and branching No.22A veins. Both contained minor amounts of argentiferous ore. In workings north of the shaft, 27 m of drifting and a 6 m raise were completed on a previously known vein, No.18, with no encouraging results. A new cobalt vein, No.32, was also discovered, but 35 m of drifting failed to identify any ore-grade material.

On the 290-foot level, exploration was confined to 140 m of drifting along a new vein, the No.31. This vein developed along the northern contact of a mafic dike intruding Huronian conglomerates immediately above the unconformity with underlying Keewatin mafic metavolcanic flow rocks. The vein consisted primarily of cobalt and no silver ore was encountered.

Before operations were suspended, broken ore remaining in stopes was hoisted to surface and stockpiled together with development muck. The ore originated from the No.23 (190-foot level), No.23A (190-foot level), and No.4-1-B (290-foot level) vein stopes. In total, approximately 2102 tons of ore grading eight ounces of silver per ton are now on surface. Samples from this muck, in general, provided assays 50 percent below those obtained by the previous operators. In addition, approximately 400 tons of broken ore, grading a similar eight ounces silver per ton, remains in stopes. Probable in-ground reserves, calculated in 12 veins, have been estimated at 7000 tons grading 10 to 13 ounces silver per ton, and inferred geological reserves of 7000 tons of 10 ounces silver per ton material suggest a total estimated mineral inventory of 193 541 ounces of silver.

KAPALUA GOLD MINES LIMITED

Briscoe–Bryce Deposit

This company carried out a major trenching program on the Briscoe–Bryce gold deposit in Bryce Township earlier this year. A total of 120 tons of ore, grading between 0.05 and 5.0 ounces gold per ton, has been stockpiled on the property (D. Birkett, President, Kapalua Gold Mines Limited, personal communication, 1988). The average grade more likely falls within the lower end of this range (0.05 to 1.34 ounces gold per ton). Grab samples of the dump material obtained by staff of the Resident Geologist's Office, Cobalt, and analyzed at the Temiskaming Testing Laboratory, assayed 0.582 ounce gold per ton in massive pyrite, and 0.566 ounce gold per ton in a quartz–calcite stringer vein system containing only minor pyrite. Ore–grade mineralization is therefore apparently present in two distinct, although possibly related environments. Despite these encouraging results diamond drilling to date has indicated an erratic nature to the gold mineralization.

The gold occurs within a 1.7 m wide zone consisting of massive pyrite and variable amounts of quartz, carbonate, and chalcopyrite. The host rock is an intensely sericitized intermediate to felsic metavolcanic rock. Fuchsite, present in minor quantities, is associated with the pyrite (Johns 1986).

The vein was originally discovered in 1938, and in 1962 a small headframe was erected over an old inclined shaft which extended down 27.2 m at a 40° angle. A 60 to 75 ton per day mill was also brought onto the property at this time (Johns 1986). No production figures were reported.

KYANITE MINING CORPORATION

Butler Kyanite

Last year, Kyanite Mining Corporation completed stripping of a one and a half acre area over a zone containing 20 percent kyanite in Antoine Township, near Crocan Lake. The face of an outcrop within this zone was blasted to provide broken material for future testing. In 1988, a 50–ton sample was removed and shipped to North Bay, where it was crushed at the Grecco Pit. Although further metallurgical testing had been planned, nothing has as yet been done. Information stemming from this program will be used in part to determine the feasibility of mining the deposit.

EXPLORATION ACTIVITY

The exploration boom of the previous year continued unabated until the middle of 1988, at which time a combination of factors, including declining precious metal prices, the impending end to flow through share funding, and lack of investor enthusiasm resulted in an abrupt decline in exploration interest in this area. Total underground and surface exploration diamond drilling decreased in 1988 by 29 percent from a year earlier. Despite this decline, the total footage of 55 112 m drilled during the year was still the second greatest this decade. Surface drilling decreased by 19.3 percent to 27 291 m and underground drilling decreased by 37.8 percent to 27 821 m (Figure 14.2). It is forecast that drilling activity in 1989 will decline significantly from these levels.

Claim staking activity declined by 53 percent from 1987, although the number of claims cancelled also declined by approximately 50 percent. This relatively stable land position is in large part the result of the relatively restricted amount of Crown land available to staking because of the Bear Island Indian Land Caution.

Although once again the majority of surface exploration focused on gold, the bulk of development and underground exploration was concentrated on silver. In marked contrast to earlier years, interest was revived in exploration for copper, nickel, platinum, metallurgical limestone and dolostone, titanium, and diamonds.

Companies, other than those described in the following section, which expressed an interest in the Cobalt Resident Geologist's District over the year included: Aurobec Resources, Bay Lake Explorations, Beak Consultants Limited, BHP–Utah Mines Limited, Castine Incorporated, Cominco Limited, Consbec Limited, Corporation of the Town of Cobalt, Dolecam Incorporated, Eaurcon, Esso Minerals Canada Limited, Heritage Canada Foundation, Hudson Lumber Company, Kerr Addison Mines Limited, Lashex Limited, Minerex Resources Limited, Monopros Limited, MPH Consultants, Northern Resources Incorporated, Northern Silver Fox Resources Limited, Northern Resources Incorporated, Pamorex, Quadra Consulting, Rea Gold Corporation, R. Bennett and Associates, Trinity Explorations, Trow Consulting and Engineering, Tully Engineering, and Winter Road Resources.

A more complete summary of exploration activity in the Cobalt Resident Geologist's District in 1988 is provided in the following sections (*see* Table 14.2 and Figures 14.1a, 14.1b, and 14.1c). Relevant Ontario Geological Survey and Geological Survey of Canada publications are listed in Table 14.1.

COBALT AREA

Armsher Resources Incorporated

Armsher Resources Incorporated completed 965.3 m of diamond drilling on a silver property in Coleman Township and Bucke Township. Drilling intersected a strong pink calcite vein, cutting Coleman Member conglomerate, which carried significant copper, lead, and zinc mineralization. An additional 610 m of diamond drilling is currently underway to test the potential for silver mineralization.

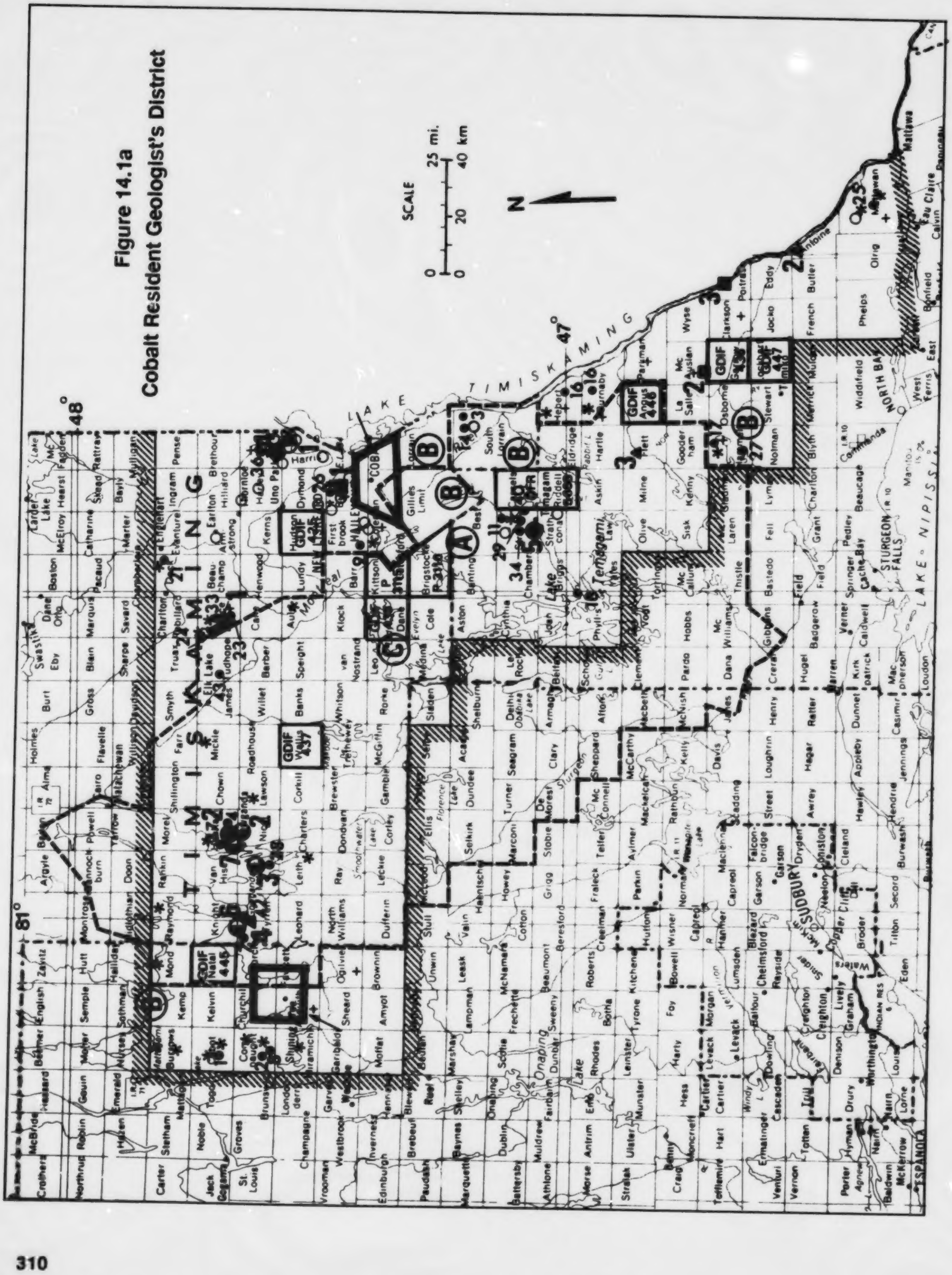

Figure 14.1a
Cobalt Resident Geologist's District

SCALE
0 20 25 mi.
0 20 40 km
N
48°
47°
81°
LAKE TIMISKAMING
TIMISKAMING
COBALT
HAILEYBURY
NEW LISKEARD
Temagami
Lake Temagami
SUDBURY
NORTH BAY
STURGEON FALLS
LAKE NIPISSING
Mattawa
ESPANOLA
Copper Cliff
GDIF Natal 445
GDIF Wallis 437
GDIF Hudson 435
GDIF 436
GDIF 446
GDIF 447

EXPLANATION

● Producing Mines, 1988
  1. Beaver – Temiskaming Mine (Agnico – Eagle Mines Ltd.) .... Ag
  2. Castle Mine (Agnico – Eagle Mines Ltd.) ..... Ag
  3. Hellens – Eplett Mine (Hellens – Eplett Mining Inc.) .... Ag
  4. Langis Mine (Agnico – Eagle Mines Ltd.) ..... Ag
  5. Sherman Mine (Dofasco, Tetapaga Mining Co. Ltd.) .... Fe

◑ Mines Under Development, 1988
  1. Penna Mine (Agnico – Eagle Mines Ltd.)

◐ Mines Undergoing Exploration, 1988
  1. Conisil Mine (Novamin Resources Inc./Canacord Resources Inc.) .... Ag
  2. Leroy Shaft (Agnico – Eagle Mines Ltd.) ..... Ag
  3. Mann Mine (Manridge Explorations Ltd.) ..... Ag
  4. Pan Silver Mine (Jascan Resources Inc.) ..... Ag
  5. Peterson Lake Decline (Agnico – Eagle Mines Ltd./Silver Century Explorations) ...... Ag
  6. Tyranite Mine (Tyranex Gold Inc./Gunnar Gold Inc./Mill City Gold Inc.) .... Au
  7. Upper Bonsall Mine (Sandy K Mines Ltd.) .... Ag

▲ Properties Under Evaluation, 1988
  1. Briscoe – Bryce Deposit (Kapalua Gold Mines Ltd.) .... Au
  2. Butler Kyanite (Kyanite Mining Corp.) .... Ky
  3. Gray – Murray Occurrence (Candol Development Ltd.) .... Ti
  4. Minto Occurrence (Duncan Gold Resources Inc.) .... Au

⊕ Mines Currently Maintained on Stand–by Basis
  1. Cleopatra Mine (Agnico – Eagle Mines Ltd.) .. Ag
  2. University Mine (Agnico – Eagle Mines Ltd.) .. Ag

■ Producing Quarries
  1. Bucke Quarry (Dymond Clay Products Ltd.) .... limestone
  2. McLaren's Bay Mica Stone Quarries (G. Boughner) .... stone
  3. Thorne Brilliant Stone Quarry (P. Pharand) . stone

⦶ Operating Mills
  1. Hellens – Eplett Mill (Hellens – Eplett Mining Inc.)
  2. Penn Mill (Agnico – Eagle Mines Ltd.)

◬ Operating Refineries
  1. Agnico – Eagle Silver Refinery (Agnico – Eagle Mines Ltd.)
  2. Cobalt Refinery (XIB Resources)

• Exploration Activity in 1988 (keyed to Table 2)

+ Claim Staking Activity in 1988

✱ Assessment Work Filed in 1988

○ Core Stored in Cobalt Drill Core Library

Ⓐ Location of Resident Geologist's Field Mapping Parties in 1988

Ⓑ Location of Ontario Geological Survey Field Mapping Parties in 1988

Ⓒ Location of Geological Survey of Canada Field Mapping Parties in 1988

—— Map, Report or Open File Report Issued by the Ontario Geological Survey in 1988

---- Areas Withdrawn from Staking through Bear Island Indian Caution

▨ Boundary of Resident Geologist's District

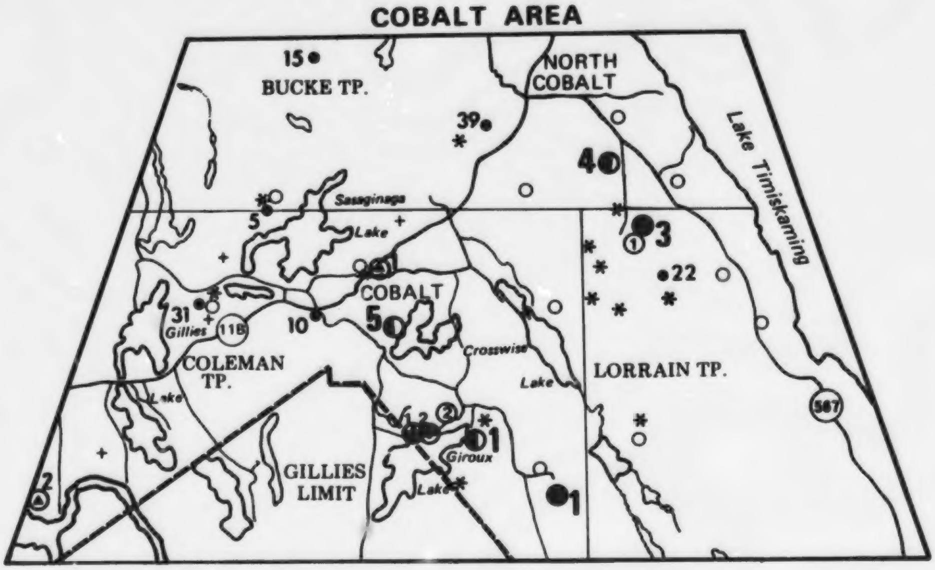
COBALT AREA
15
BUCKE TP.
NORTH COBALT
39
4
Lake Timiskaming
Sasaginaga
Lake
5
3
1
22
31
Gillies
11B
10
COBALT
5
COLEMAN TP.
Crosswise
Lake
LORRAIN TP.
567
Lake
2
GILLIES LIMIT
2
Giroux
Lake
1
1

Figure 14.1b. Cobalt Resident Geologist's District. *For legend, see Figure 14.1a.*

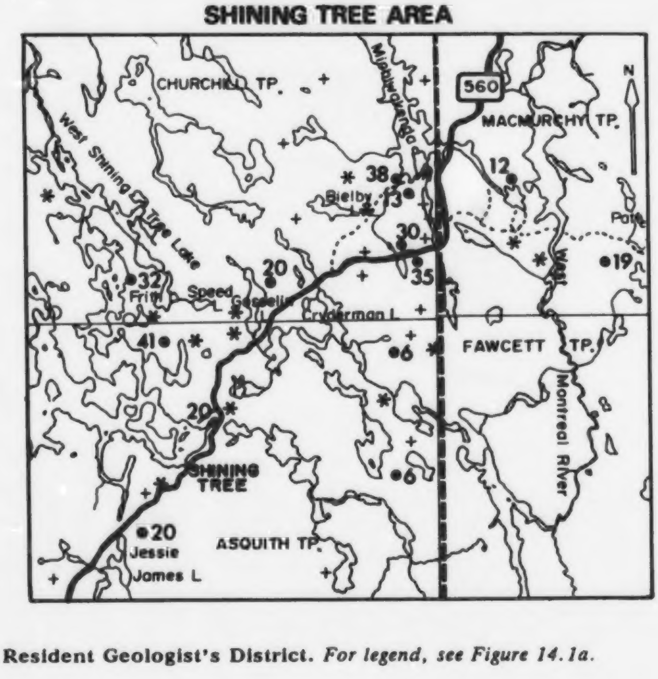
SHINING TREE AREA
CHURCHILL TP.
Mihkwa Lake
560
N
MACMURCHY TP.
West Shining Tree Lake
38
12
Bielby
13
30
Pa
19
20
35
32
Frith
Speed L.
Gosselin
Cryderman L.
41
6
FAWCETT TP.
Montreal River
20
SHINING TREE
6
20
Jessie
James L.
ASQUITH TP.

Figure 14.1c. Cobalt Resident Geologist's District. *For legend, see Figure 14.1a.*

TABLE 14.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	A.C.A. Howe International Limited	Geological mapping, lithogeochemical sampling, Cabot Township
2	A.C.A. Howe International Limited	Geological mapping, lithogeochemical sampling, Connaught Township
3	Agnico-Eagle Mines Limited	Linecutting, geological mapping, lithogeochemical sampling, South Lorrain Township
4	Agnico-Eagle Mines Limited	Linecutting, geological mapping, diamond drilling, Nicol and Haultain Townships
5	Arusher Resources Incorporated	Prospecting, diamond drilling, Coleman and Bucke Townships
6	Asquith Resources Incorporated	Linecutting, geological mapping, geophysical surveys, trenching, Asquith Township
7	Asquith Resources Incorporated	Stripping, trenching, lithogeochemical sampling, Tyrrell Township
8	Asquith Resources Incorporated	Prospecting, geological mapping, Connaught Township
9	Bethlehem Resources Corporation	Prospecting, geological mapping, Firstbrook and Coleman Townships
10	Can-Cal Development Corporation and New Plymouth Ventures Incorporated	Geological evaluation, Coleman Township
11	Canadian Nickel Company Limited	Diamond drilling, Strathy Township
12	Chesbar Resources Incorporated	Diamond drilling, Macmurchy Township
13	Chesbar Resources Incorporated	Prospecting, Churchill Township
14	Danra Resources Limited	Linecutting, geophysical surveys, South Lorrain Township
15	Falconbridge Limited	Linecutting, geological mapping, geophysical surveys, diamond drilling, Bucke Township
16	Falconbridge Limited	Geophysical surveys, stripping, Hebert and Burnaby Townships
17	Falconbridge Limited	Geophysical surveys, Hammell Township
18	Greater Temagami Mines Limited	Trenching, lithogeochemical sampling, diamond drill core re-evaluation, Phyllis and Briggs Townships
19	Greater Temagami Mines Limited	Diamond drilling, Macmurchy Township
20	Gunter, C.	Stripping, trenching, Asquith and Churchill Townships
21	Halex Resources Limited	Diamond drilling, Dack Township
22	Hellens-Eplett Mining Incorporated	Geophysical survey, diamond drilling, Bucke Township
23	Highrock Contracting Limited	Prospecting, trenching, rock and soil geochemical sampling, Bryce Township
24	Hudson Bay Exploration and Development Company Limited	Basal till geochemical sampling, stripping, diamond drilling, Bryce Township
25	Janveaux, J.M.	Stripping, trenching, Mattawan Township
26	Lac Minerals Limited	Diamond drilling, Bucke Township
27	Mackie, W.M.	Prospecting, stripping, Hammell Township
28	Manridge Explorations Limited	Diamond drilling, Milner Tonwship
29	Manridge Explorations Limited	Geophysical surveys, stripping, lithogeochemical sampling, Strathy Township
30	McBride, G.	Prospecting, Churchill Township
31	McDonald, I. and Brydges, D.	Prospecting, diamond drilling, Coleman Township
32	Nealand Mining and Exploration Limited	Diamond drilling, Churchill Township
33	Noranda Exploration Company Limited	Linecutting, geological mapping, diamond drilling, Bryce Township
34	Northern Platinum Limited	Linecutting, geological mapping, stripping, trenching, diamond drilling, Strathy Township
35	Norwin Resources Limited	Prospecting, geological mapping, Churchill Township
36	Pronto Explorations Limited and Seal River Explorations Limited	Diamond drilling, Casey Township
37	Sandy K Mines Limited	Geophysical surveys, geological mapping, Nicol and Haultian Townships
38	Shiningtree Resources Incorporated	Prospecting, Churchill Township
39	Silvern Resources Limited	Geophysical surveys, diamond drilling, Bucke Township
40	Stroud Resources Limited, Exador Resources Incorporated, and Lacana Mining Corporation	Diamond drilling, Strathy Township
41	Teck Corporation	Geophysical surveys, Asquith Township

TABLE 14.2 Continued

Number on Figure	Individual or Company	Activity
42	Tyranex Gold Incorporated, Gunnar Gold Incorporated, Mill City Gold Incorporated, and Norwin Resources Limited	Diamond drilling, Tyrrell and Knight Townships
43	Welsh, B.M.	Prospecting, Tudhope Township

Falconbridge Limited

Falconbridge Limited completed line cutting, geological mapping, and ground geophysical surveys on a large claim group in Bucke Township. The claims are situated in a part of the camp containing few previously recorded mineral occurrences and little evidence of past exploration. They straddle a major regional structural feature called the Cross Lake Fault (Owsiacki and Anderson 1988). Seven diamond drill holes were put down on two distinct magnetic anomalies, which proved to be beds of steeply dipping Keewatin jasper–magnetite banded iron formation, hosted within mafic metavolcanic rocks. The sediments exposed at surface in this area were previously interpreted as Timiskaming in age but may in fact be Keewatin interflow sediments. The drilling also intersected intriguing red syenitic dikes, which cut both Huronian and Archean lithologies.

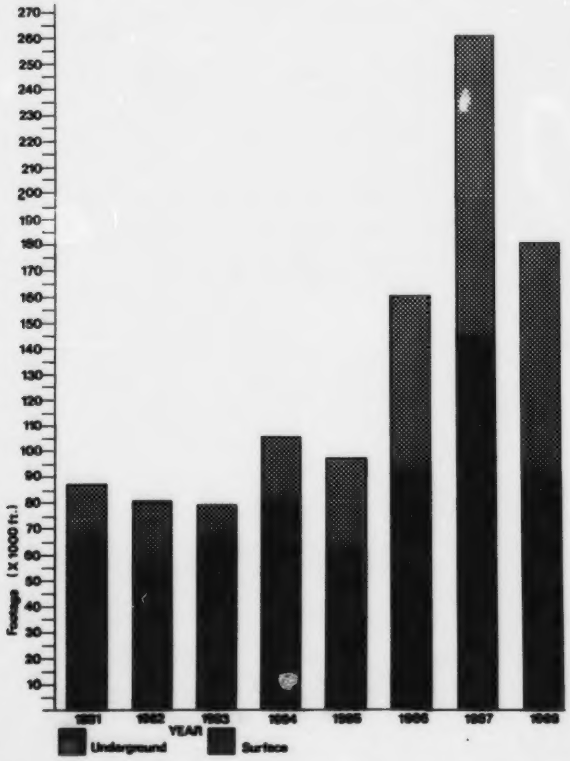

Figure 14.2. *Exploration diamond drilling activity in the Cobalt Resident's District.*

Lac Minerals Limited

Lac Minerals Limited completed diamond drilling of two vertical 274.3 m holes on a possible kimberlite pipe located in Bucke Township. This area was previously explored and drilled by Monopros Limited (Owsiacki and Anderson 1988). The latter company has closed its area office.

Pronto Explorations Limited–Seal River Explorations Limited

Pronto Explorations Limited and Seal River Explorations Limited completed the final 742 m of a 3048 m diamond–drill program begun in 1987, on their Casey Mountain Property in Casey Township. Drilling encountered an oxidized hematitic zone within limestone, unconformably overlying Nipissing diabase which intrudes Coleman Member conglomerates and Archean syenite. Although only a few minor silver intersections were encountered, drilling defined a number of structurally interesting areas which could host carbonate vein systems. The property is located near the Agnico–Eagle Mines Limited new Penna Shaft.

Silvern Resources Limited

Silvern Resources Limited recently completed 914.4 m of diamond drilling on several VLF–electromagnetic (EM) targets the company had defined earlier in the year on their North Cobalt Property. According to H. Moore, Geologist, Silvern Resources, the Huronian–Keewatin contact was intersected at an average vertical depth of 266.7 m. Although a number of strong fault zones were also intersected, no significant mineralization was encountered. The company plans to drill another 1524 m on the property in the near future.

Hellens–Eplett Mining Incorporated

Hellens–Eplett Mining Incorporated completed a deep–pulse electromagnetic survey on their mine property in Lorrain Township. This work was followed up with 1311 m of diamond drilling, which failed to identify any significant mineralization.

Can/Cal Development–New Plymouth Ventures

Two Vancouver companies, Can/Cal Development and New Plymouth Ventures, hired a geological consultant to appraise the formerly producing Silver Queen Mine property of Starlight Energy Corporation for possible purchase. Exploration and some mining was completed on this claim in the past (Owsiacki 1985) and possible reserves identified. The report concluded that little ore is present in dumps on the site and only a modest amount of silver has been identified in extensions of old structures. The companies are apparently not proceeding with the purchase.

I. McDonald, and D. Brydges

I. McDonald and D. Brydges completed 31.7 m of diamond drilling on a two-claim block near the southwestern corner of Clear Lake in Coleman Township. Quartz-carbonate veins carrying disseminated pyrite were intersected over a 0.3 m width in Keewatin interflow sediments. A number of old shafts in this area were previously put down on similar graphitic interflow sediments and narrow carbonate veins to test for silver mineralization. In the spring of 1989, a single diamond-drill hole is planned to test overlying Huronian conglomerate for potential structures related to an inferred fault zone and for extensions of the underlying Keewatin interflow sediment bands.

Bethlehem Resources Corporation

Bethlehem Resources Corporation optioned a small claim group from J.R. Ewanchuck in Coleman and Firstbrook townships, adjacent to McLaren Lake. The company carried out prospecting, geological mapping, and sampling along the contact between a Nipissing diabase sill and underlying Firstbrook Member laminated argillites.

Danra Resources Limited

Danra Resources Limited completed line cutting and ground geophysical surveys on a three-claim group located at Silver Centre in South Lorrain Township. The property, commonly known as the Forneri Group, hosts a smaltite-chalcopyrite-bearing calcite-quartz vein within a fault zone cutting Coleman Member conglomerate. In 1925, The Mining Corporation of Canada Limited sunk a 61 m shaft and completed 91.4 m of drifting. This low-grade vein is thought to be an extension of the Watson Vein, which yielded over seven million ounces of silver at the Frontier Mine of Canadian Keeley Mines Limited (McIlwaine 1970).

Agnico-Eagle Mines Limited

Agnico-Eagle Mines Limited completed a surface exploration program of line cutting, geological mapping, and sampling at the former Canadian Lorrain Mine in South Lorrain Township. Between 1926 and 1943, this mine produced over 250 000 ounces of silver, with the last activity at this site being completed in 1963. The area is underlain by Keewatin intermediate to mafic metavolcanic rocks intruded by several phases of steeply dipping diabase. Faulting is extensive, and ore veins were reported to have been small, but high grade (McIlwaine 1970). A similar program is planned for next year at the company's Trout Lake Property at Silver Centre.

Agnico-Eagle Mines Limited leased the Bursary Silver Mines Limited Property in Coleman Township. The ground is located immediately west of the Beaver-Temiskaming Mine and was the site of a new, surface, high-grade silver find a few years ago (Owsiacki 1987).

Sunmist Energy '86 Incorporated

Plans by Sunmist Energy '86 Incorporated to purchase, refurbish, and initiate a $750 000 underground exploration program at the former Keely-Frontier Mine in Silver Centre have fallen through. The property is now owned by a numbered company, 155433 Canada Limited, which has no immediate plans to explore the ground (Northern Daily News, May 8, 1988). Last winter, the Frontier Mine headframe, hoistroom, and mill building were scavenged and are now in an advanced stage of deterioration.

ENGLEHART AREA

Exploration activity in this area, particularly in Bryce Township, continued to expand this year, reflecting a strong interest in gold potential. No fewer than six companies performed work, focusing their attention on auriferous carbonatized shear zones.

Hudson Bay Exploration and Development Company Limited

The Hudson Bay Exploration and Development Company Limited completed 365.8 m of diamond drilling on a seven-claim group in Bryce Township, near Heather Lake. The holes were put down to test gold anomalies outlined by a basal till sampling program completed in 1987. Several auriferous quartz-carbonate stringer vein systems were intersected within shear zones cutting intermediate to felsic breccias and porphyritic metavolcanic rocks of the Abitibi Belt (R. Davies, Geologist, Hudson Bay Exploration and Development Company Limited, personal communication, 1988). These rocks are in turn intruded by quartz-feldspar porphyries, gabbro, and diabase.

Halex Resources Limited

Halex Resources Limited continued exploration on the 12-claim Hillcrest (Mowat) Property in Dack Township. An additional 115.4 m of diamond drilling was completed and chip samples obtained from existing trenches. The property hosts massive, white, well-fractured quartz veins, up to 1 m in width, which occur within a carbonatized, bright green, fuchsite schist shear zone cutting mafic metavolcanic rocks. An old shaft was previously put down to a depth of 13.7 m on this zone to test surface gold showings. Previous drilling in this area suggested that gold occurred in a zone measuring 68.6 m by 7.6 m by 1.5 m wide. This company drilled one hole near the shaft to confirm values recorded in the previous work. One intersection returned an assay of 0.10 ounce gold per ton (Owsiacki and Anderson 1988).

Highrock Contracting Limited

Highrock Contracting Limited acquired 11 claims in southwestern Bryce Township, adjoining the Hudson Bay Exploration and Development Company Limited property. The claims are underlain by Archean intermediate and mafic metavolcanic rocks, which are unconformably overlain by Gowganda Formation Coleman Member conglomerate and intruded by Nipissing diabase (Johns 1986). Prospecting, trenching, soil geochemistry and rock geochemistry were completed, primarily on quartz–carbonate-bearing shear zones within the metavolcanic rocks. While several old test pits were recently discovered, little previous information on this property is available. Johns (1986) stated that from 1962 through 1967, the Decaire Mining Company Limited obtained assays as high as 0.98 ounce gold per ton from grab samples of shear zones located 800 m north of the Highrock claims. One sample obtained by staff of the Resident Geologist's Office, Cobalt, from an ankerite-bearing shear zone in mafic metavolcanic rocks 25 m north of a previously unmapped fault, assayed 0.05 ounce gold per ton (Temiskaming Testing Laboratory, Cobalt). Several white quartz veins, up to 0.3 m in width, were also observed. Similar zones are common, not only on the Highrock Property, but throughout the Archean metavolcanic belt in the Englehart area.

Placer Dome Incorporated

Placer Dome Incorporated completed magnetometer and VLF–EM surveys, in addition to geological mapping and sampling, on nine claims in northwestern Bryce Township. These claims include part of the Terry Gold Exploration Company Limited property (Paquette claims) and the Mearow–McCombe [1939] Property. The claims are underlain by medium- to coarse-grained tonalite of the Round Lake Batholith, and relatively small inliers of older layered amphibolitic metavolcanic rocks (Johns 1986). Chalcopyrite was reported by Moorhouse (1944) from altered joints in the felsic intrusive rock, forming mineralized zones up to 1.5 m in width. The host rocks adjacent to the veins are sericitized, silicified, and carbonatized. An intense shear zone is located at the tonalite–metavolcanic contact exposed in the southern part of the claim group (Moorhouse 1944).

Noranda Exploration Company, Limited

Noranda Exploration Company, Limited carried out line cutting, geological mapping, and 240 m of diamond drilling on the Britcanna Gold Prospect in central Bryce Township. The property is underlain by Keewatin metabasalts which have been intruded by a feldspar porphyry of similar age and several lamprophyre dikes (Johns 1986). Silicified shear zones within the porphyry have been explored in the past for gold and silver. A total of 22 tons of ore, grading 1.2 ounces gold per ton and 22 ounces of silver per ton, were shipped to the Noranda smelter in the late 1930s (Moorhouse 1944).

SHINING TREE AREA

Exploration in the Shining Tree area continued at a very active pace throughout the year. On June 1, 1988, 24 formerly patented mining claims, located in the southwestern corner of Churchill Township, were reopened to staking. This resulted in a small staking rush with numerous companies, including Inco Limited, Chesbar Resources Incorporated, Norwin Resources Limited, Teck Corporation, Strike Resources Limited, and Shining Tree Resources Incorporated, among others, taking part. Most of these claims surround areas hosting some of the numerous historical gold–bearing quartz veins of the Shining Tree area and are close to the old Ronda Mine. This mine produced 2727 ounces of gold and 4380 ounces of silver from 24 592 tons of ore milled in its sole year of production in 1939 (Tremblay 1941). Throughout much of the year, Churchill, Asquith, Cabot, and Connaught townships were subject to continuous, moderate to heavy staking activity based on gold potential. Exploration in Tyrrell and Macmurchy townships was reduced, and restricted to patented or leased properties, only because these townships lie within the Bear Island Indian Land Caution.

Tyranex Gold Incorporated–Gunnar Gold Incorporated–Mill City Gold Incorporated

Tyranex Gold Incorporated, Gunnar Gold Incorporated, and Mill City Gold Incorporated completed 8534 m of surface diamond drilling on the Main Zone, and 8534 m of surface diamond drilling on the Duggan Zone at the Tyranite Mine in Tyrrell Township. The drilling was undertaken to verify and increase known gold reserves at the two deposits. Much of the supervision of this phase of exploration was provided by Norwin Resources Limited. The work complements the underground rehabilitation and exploration program initiated at the mine and described in an earlier section.

Asquith Resources Incorporated

Asquith Resources Incorporated actively explored ground in at least three townships in the area this year. They recently completed stripping and sampling on the Matona gold property in Tyrrell Township. The main occurrence on this property had an existing two–compartment shaft, which was sunk in 1936 on a 30 m wide by 180 m long shear zone. The shear carried quartz, carbonate, pyrite, and visible gold mineralization. Two levels were established at 125 feet and 213 feet, but development was suspended in 1937. Subsequent diamond drilling defined reserves of 30 000 tons grading 0.385 ounce gold per ton (Assessment Files, Resident Geologist's Office, Cobalt). Carter (1977) stated that this occurrence is hosted within felsic metavolcanic rocks in the upper part of a volcanic sequence.

The company also investigated a second occurrence on this property, the Hare Creek Zone, during the year. Stripping and trenching provided samples with assays up to 0.785 ounce gold per ton over a 1 m interval. The company is presently negotiating for a joint venture partner to provide funding to initiate a follow-up diamond-drill program. Line cutting, ground geophysical surveys, geological mapping, stripping, and sampling were also carried out on the company's properties in Asquith Township and Connaught Township. An application has been made by the company for a listing on the Alberta Stock Exchange.

Duncan Gold Resources Incorporated

Duncan Gold Resources Incorporated dewatered a small open pit, mined previously by the company in Tyrrell Township. Fourteen 12.2 m vertical holes were drilled into the pit floor in an attempt to identify further gold reserves. Last year, the company mined a 6000-ton bulk sample, which graded approximately 0.11 ounce gold per ton, and intends to deepen the pit another 12.2 m if grades warrant.

The ore zone occurs in a silicified and brecciated felsic metavolcanic pipe surrounded by a quartz-carbonate stringer zone. Visible gold was observed within the latter unit by staff of this office. Previous diamond drilling suggests that the ore zone extends down to a depth of 366 m. Any ore mined will be shipped to the Diepdome Mines Limited mill in Timmins.

Greater Temagami Mines Limited

Greater Temagami Mines Limited completed a 1524 m diamond-drill program on the Triton Property of Nu-Dawn Resources Limited in Macmurchy Township. The property includes the former Kingston Mine and former Shiningtree Mine. The exploration targeted the extensions of gold-bearing quartz veins hosted in a 180 m by 1 m wide shear zone. No previous production was reported from these occurrences (Carter 1977). A chip sample from the Bennett Vein at the Shiningtree Mine, obtained by staff of the Resident Geologist's Office, Cobalt, was analyzed at the Temiskaming Testing Laboratory and assayed 0.57 ounce gold per ton over a 0.3 m interval.

A.C.A. Howe International Limited

A.C.A. Howe International Limited carried out prospecting, ground magnetometer and VLF-EM surveys, geological mapping, and sampling on several claim groups in the Shining Tree area. Previously unknown gold occurrences, with samples assaying up to 0.151 ounce gold per ton, were discovered on claims in Cabot Township. The gold occurred together with chalcopyrite and pyrite mineralization within what was previously described as the old Jonsmith Mines Limited copper occurrence. The mineralization was confined to an intensely altered shear zone. In Connaught Township, gold was discovered in two separate areas. Near Burns Lake, copper and gold mineralization was observed, and assays up to 0.09 ounce gold per ton were obtained from samples taken near Elephant Head Lake (D. Gignac, Geologist, A.C.A. Howe Limited, personal communication, 1988).

Chesbar Resources Incorporated

Chesbar Resources Incorporated completed 1791 m of diamond drilling on the Tut Property in Macmurchy Township. The drilling was undertaken to follow up previously identified geophysical targets. The claim group, historically known as the Caswell or Westree Property, contains two old shafts and numerous veins. Intermittent exploration between 1911 and 1939 included trenching, diamond drilling, shaft sinking, drifting, and sampling. This work identified erratic gold values in quartz-carbonate veins containing visible gold. The company states that the latest drilling encountered favourable gold mineralization (R. Reukl, Geologist, Chesbar Resources Limited, personal communication, 1988).

Nealand Mining and Exploration Limited

Nealand Mining and Exploration Limited drilled two holes totalling 205 m on claims located near West Shining Tree Lake in Churchill Township. Gold mineralization in this area is normally found within pyritiferous quartz-carbonate stringer veins hosted in interbedded mafic and felsic metavolcanic flow rocks (Carter 1980).

Shiningtree Resources Incorporated

During the year, Shiningtree Resources Incorporated acquired claims hosting two known gold occurrences in Churchill Township. One is historically known as the Gold Corona Vein and is described as a shear-type quartz vein in which the gold occurs with quartz and pyrite cutting rhyolite, iron formation, and metabasalt. Previous exploration on this vein included trenching, channel sampling, diamond drilling, and shaft sinking. No work had been carried out by the company on this vein at the time of writing.

The second occurrence, called the Cochrane vein, cuts interbanded oxide facies iron formation and intermediate metavolcanic rocks (Carter 1980). Extensive stripping was completed on this vein by Shiningtree Gold Resources Incorporated several years ago. The company also has a small mill on the property. Grab samples obtained from the Gold Corona Vein and Cochrane vein by staff of the Resident Geologist's Office, Cobalt, and analyzed at the Temiskaming Testing Laboratory, assayed 1.814 ounces gold per ton and 0.416 ounce gold per ton, respectively. The company plans to carry out stripping and diamond drilling in the near future.

Teck Corporation

Teck Corporation completed ground magnetometer and VLF–EM surveys on claims located near Shining Tree Lake in Asquith Township.

G. McBride

G. McBride prospected for gold on Crown Lands surrounding his leased claims in Churchill Township, and plans diamond drilling of targets located on the leased ground in the future. The McBride Occurrence is one of the original showings in the area and consists of a 0.6 m wide by 9.0 m long quartz vein containing up to five percent chalcopyrite within pink, aphanitic, and porphyritic rhyolite (Carter 1980).

C. Gunter

C. Gunter completed a small program of stripping, blasting, and trenching on gold–bearing quartz–carbonate veins exposed on three separate claim groups in Churchill Township and Asquith Township. The best grab samples, obtained by staff of the Resident Geologist's Office, Cobalt, and analyzed at the Temiskaming Testing Laboratory, were from the Gosselin Occurrence and assayed 0.102 ounce gold per ton.

GOWGANDA–ELK LAKE AREA

Agnico–Eagle Mines Limited

Agnico–Eagle Mines Limited completed 88.5 km of line cutting on their recently acquired Leroy Lake Property in Nicol and Haultain townships. This work was followed by geological mapping, geochemical sampling, and a 12–hole diamond–drill program (1500 m) to test for silver mineralization. Additional drilling was underway at the time of writing, with 457.2 m proposed to be completed this winter (D. Marek, Mine Geologist, Agnico–Eagle Mines Limited, personal communication, 1988).

Manridge Explorations Limited

Manridge Explorations Limited completed 1798 m of diamond drilling in 18 holes at their Mann Mine silver property in Milner Township. The holes targeted geochemical anomalies which had been identified earlier in the program. Results were disappointing. A later drill program did, however, intersect a vein assaying 83 ounces of silver per ton over a 2.7 m interval in one hole. Continued surface exploration of the property will be dependant on raising additional financing (A. Parcher, Project Manager, Manridge Explorations Limited, personal communication, 1988).

Manridge Explorations Limited completed an exploration program on eight patented claims in Strathy Township. A detailed IP (induced polarization) survey was carried out over 24.1 km of cut line and identified several anomalies. Subsequent stripping exposed altered lenses of mafic intrusive rock containing pyrite (A. Parcher, Project Manager, Manridge Explorations Limited, personal communication, 1988). In this area, gold and nickel are commonly associated with pyrite in shear zones cutting similar mafic metavolcanic and mafic intrusive rocks. The recent work, however, failed to produce any significant gold values and the option on the claims has been terminated.

B.M. Welsh

B.M. Welsh and associates commenced prospecting and completed surveying the boundary around four patented claims and seven leased claims at the former Paragon–Hitchcock copper and silver mine in Tudhope Township. A 103 m shaft was sunk on a chalcopyrite–bearing aplite vein and worked on three levels between 1918 and 1927. No production figures were available for this property. Some erythrite was observed in trenches, but no silver mineralization was evident from the dump. The property is underlain by a variety of rock types, including granodiorite of the Round Lake Batholith, Nipissing diabase, Huronian conglomerate, and Keewatin metavolcanic rocks. Two other old shafts were sunk on similar chalcopyrite and erythrite mineralization at the diabase–metavolcanic rock contact.

Sandy K Mines Limited

Sandy K Mines Limited contracted Derry, Mitchener, Booth & Wahl Limited to carry out ground magnetometer and VLF–EM surveys as well as geological mapping of their claim group at the Upper Bonsall Mine near Gowganda.

TEMAGAMI AREA

Exploration interest declined marginally from last year in this area. Most programs carried out were, however, greater in scope than those last year and involved significant expenditures. Gold, platinum group metals, and to a lesser extent, copper and nickel were the primary targets.

Stroud Resources Limited

Early in 1988, Stroud Resources Limited completed a 7827 m diamond–drill program on the Leckie Project (formerly the Penrose Mine) in Strathy Township. This company, together with two others, have intermittently carried out drilling over the last two years on this property. In the latest drilling, one hole was reported to have intersected 0.237 ounce gold per ton over a 9.36 m interval at a depth of 213.4 m on the Main Zone. The most recent program has resulted in a new reserve calculation of 193 000 tons grading 0.215 ounce gold per ton. The gold mineralization is associated with arsenopyrite, pyrite, and chalcopyrite which occur within locally sheared mafic metavolcanic rocks (Bennett 1978).

Exador Resources Incorporated can earn a 30 percent interest in the property by expending

$1 million on exploration by June 1989; Lacana Mining Corporation would then retain 40 percent, and Stroud Resources Limited the remaining 30 percent interest. The companies plan to resume drilling in the near future to further expand reserves in the Main Zone, and to continue exploration of a second gold occurrence, located southwest of the Main Zone.

Northern Platinum Limited

Northern Platinum Limited continued exploration at the formerly producing Kanichee Mine in Strathy Township. The company is searching for copper, nickel, and platinum. They completed line cutting, trenching and channel sampling, and recently concluded a 760 m diamond–drill program, which identified extensions of the old orebody, and outlined additional reserves of 249 250 tons grading 0.84 percent copper and 0.54 percent nickel. This is in addition to previously defined reserves of 688 800 tons grading 0.46 percent copper and 0.29 percent nickel (Bennett 1978). The bulk of the ore occurs within a major shear zone cutting serpentinized peridotite of the Ajax Ultramafic Intrusion (Bennett 1978).

P. Sheridan Ltd. crews also carried out an evaluation of the 200 ton per day mill which remains on the site in the event that a production decision is made. The companies have also investigated the possibility of reprocessing tailings to recover platinum.

Greater Temagami Mines Limited

Greater Temagami Mines Limited, a company formed in 1987 to manage exploration of Keevil properties falling within the area of the Bear Island Indian Land Caution, continued to re–log and sample diamond–drill core for gold and platinum at the formerly producing Temagami Copper Mine. On the mainland, a litho–geochemical sampling program for gold and platinum was completed in an area hosting several old trenches exposed along a contact between the Temagami Island Gabbro and felsic metavolcanic rocks.

Canadian Nickel Company Limited

The Canadian Nickel Company Limited recently completed a diamond–drill program on patented claims located near Net Lake in Strathy Township. The holes were drilled to test several targets identified from a previous geophysical survey in the vicinity of the Vermilion Lake Fault. This is a northeast–trending structure which defines the contact between felsic and intermediate to mafic metavolcanic rocks (Bennett 1978) and hosts many gold occurrences along strike. The company also investigated mineralization occurring within an intensely altered and complex metagabbro. This unit contains zones of massive pyrite cut by several quartz vein systems. Grab samples from these zones by staff of the Resident Geologist's Office in Cobalt, and analyzed at the Temiskaming Testing Laboratory, assayed 0.141 ounce gold per ton and 2.145 percent copper.

NORTH BAY AREA

Exploration activity in this area increased during the year as did the variety of commodities being searched for. In addition to building stone and gold, base metals, titanium, diamonds, and silica were targeted. This activity reflects a growing interest in the mineral potential of this part of the Grenville structural province, which began a few years ago after recommendations from this office.

Falconbridge Limited

Falconbridge Limited completed an airborne survey over parts of the Grenville Front earlier in the year. A follow–up ground magnetometer and VLF survey were subsequently completed on a grid covering part of a claim group staked in Hammell Township. These surveys identified the presence of a weak anomalous zone, which was stripped to reveal an 800 m long zone of banded and disseminated magnetite, hosted within quartz monzonite. The company also staked several claims in nearby Hebert Township and Burnaby Township. Line cutting and geophysical surveys were carried out on these claims. Exploration is being focused on base–metal potential and possible gold and platinum associated with intrusive gabbros. The area is also cut by major northwest–trending faults, with which kimberlites are spatially associated farther to the north.

W.M. Mackie

W.M. Mackie prospected and stripped overburden from outcrop on two claims in Hammell Township. These claims lie immediately to the south of the Falconbridge Limited property.

Candol Developments Limited

Candol Developments Limited optioned a large block of patented claims in Flett Township earlier this year, which include a known titaniferous iron deposit. The company completed a fly–in bulk sampling program on the ilmenite–rich occurrence. The ilmenite is hosted in a layered and mineralogically zoned mafic complex, located northeast of Fanny Lake in Grenville age rocks. The company is investigating the feasibility of synthesizing rutile from this deposit.

J.M. Janveaux

A property visit to claims held by J.M. Janveaux, located near Kearney Lake in Mattawan Township, revealed stripping and minor trenching of outcrop containing several northeast–trending albite–quartz–biotite pegmatite dikes intruding biotite–hornblende–garnet schist. The dikes dip steeply and are relatively narrow (<2 m). Janveaux is interested in the albite for its potential applications in the ceramics industry.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

During the year, the Cobalt office was staffed by Resident Geologist, Leo Owsiacki; Secretary, Karen Larabie; Contract Geologist, Pat Anderson; and Experience '86 students, D. McKnight, J. Pinkney, and B. Gray. In addition, Mike Cosec was hired as Staff Geologist in February 1988.

In April 1988, the Cobalt Resident Geologist's Office started selling claim tags, and issuing and renewing prospectors licenses as part of an effort to increase service to area residents. The office also sells all Mines and Minerals Division publications and maps which pertain to the area. These services have been very favourably received by the mining community. Sales of publications reached record levels this year and increased by 180 percent from last year. This increase is due in part to boundary changes initiated in March 1987, in part to an increase in exploration, and in part to an increase in publications which provided new exploration information on this area in particular.

Staff devoted an increasing amount of their time reviewing proposals for property severances, Municipal Zoning Plans, Northern Ontario Regional Transporation Committee (NORTC) mine road improvement requests, Ministry of Natural Resources Timber Management Plans, land withdrawal requests, and Lake Plans. In all cases, mineral potential and possible hazards were identified and the information provided for input into these plans. Assistance was also provided to the Cobalt Northern Ontario Mining Museum in maintenance of the Heritage Silver Trail, a mining tourist attraction designed and built by this office a few years ago. Tourist use of the trail increased by approximately 15 percent compared to last year. The office once again represented the Ministry at the Cobalt Miner's Festival, which was held July 29th through July 31st. Staff participated on the planning committee and manned displays featuring area geology, mining history and area exploration.

Numerous field trips were provided during the year for a variety of organizations and individuals. Some of these included representatives of the Heritage Canada Foundation, town of Kirkland Lake and Community Futures Program, Ministry of Natural Resources Junior Rangers, and Cobalt Miner's Festival; students from the universities of Karlsruhe and Cologne, and New Liskeard Public School; and geologists from Esso Minerals Limited, Cominco Limited, and BHP–Utah Mines Limited. In addition, lectures were provided to Junior Rangers, and students of New Liskeard Public School and Ecole Sainte Croix in Haileybury.

Staff also attended and (or) participated in a number of seminars during the year, including the two–week "What's at Stake" Mining Lands course held at the Haileybury School of Mines and a Geophysics Forum, also held at the Haileybury School of Mines. Map displays were prepared and presented at the Ontario Mines and Minerals Symposium held in Toronto, and at the Northeastern Region Geoscience Seminar held in Timmins.

Staff geologists visited over 23 active properties to provide assistance, and 19 inactive properties to obtain additional data on mineralization or geology. These properties were visited a number of times over the course of the year.

The Resident Geologist was primarily occupied during the year with administration, management, and completion of a mapping project started in 1986. Technical assistance and consultative services were also provided to prospectors, industry representatives, geologists, government personnel, and the general public as a means of encouraging and facilitating effective exploration and development in the area. Over the year, an increasing amount of time (62 percent) was spent in managing the office and staff and responding to office visitors and inquiries. The remainder of time was divided equally between attending meetings and field work. A number of property visits were completed and mapping of Banting Township and part of Best Township was continued. Much time was spent this year participating on a wide range of Ministry committees including the Communications and Client Services Sub–Committee, and Task Groups associated with these committees, as well as attending meetings dealing with Ministry of Natural Resources Forestry activities and technical and work planning meetings. In addition, seminars on Performance Management and the new Workplace Hazardous Materials Information System were attended.

Use of the facilities and services provided by the Resident Geologist's Office maintained a record pace at levels comparable with 1987. However, a nine percent increase in the first three–quarters of the year dissipated rapidly in the fourth quarter and reflects the marked slowdown in exploration and development which began in July. Many projects initiated in the past few years are continuing and some are described in more detail in the following sections. These projects are aimed at expanding the local economic base and providing new data to assist in finding and developing new commodities, and at expanding our knowledge of the geology and ore–forming processes in the camp.

HAZARD LANDS

P. Anderson continued to assist the Ministry of Natural Resources Kirkland Lake District Office in their 1987–1988 Mine Hazards Program. This project was initiated to identify and inspect potential mine hazards located in the Elk Lake and Gowganda areas and to provide recommendations for remedial action. Following assessment file research, 39 properties in 11 townships in the northern part of the Cobalt Resident Geologist's area were inspected by F. Erikson of the Ministry of Natural Resources. A total of 91 hazards were identified, including open shafts, pits, and trenches. The most hazardous of these were subsequently inspected by R. Kennedy from the Ministry of Labour, K. Alexander of the Ministry of Natural Resources, and P. Anderson of the Ministry of Northern Development and Mines.

Following these inspections, 10 pits and shallow shafts were filled, at a cost of $1500, in 1987. In 1988, 5 shafts were capped and 15 openings filled at a cost of $35 000. Several additional openings identified in the program will be protected when further funding becomes available.

Four potentially hazardous areas were reported by the public to this office during the year; they are located in Coleman, Bucke, Gilles Limit, and Harris townships. Three of these were investigated and referred to the Ministry of Labour for action. As a result, the Argyle shafts in Bucke Township have been capped and two nearby pits filled. File searches were also undertaken and interviews conducted in an effort to establish the potential danger in two other possibly hazardous locations at Ste. Therese School and at a Lang Street property in the town of Cobalt. This search revealed that workings were too deep to represent a potential hazard.

Other potentially hazardous areas within the Cobalt town limits were also investigated during the year by consultants Golder & Associates. Earlier drilling and geophysical surveys by this company, conducted over a stope at the City Shaft, suggested that the bedrock was absent or very thin at this location. The stope is beneath the front lawn of a senior citizen's residence on Miller Avenue. The company has since completed further testing of the ground using a video camera and Lundahl DCU–S ultrasonic distance sensor. This equipment was lowered down into the stope in November and yielded profiles at 1.5 m intervals down through the shaft and stope. A remotely operated Phantom 500 submersible self–propelled vehicle, equipped with a high resolution Mesotech colour scanning sonar and remote–control, colour underwater television camera, was subsequently used to provide video film of the workings up to a distance of 136.5 m from the shaft. On the same day, company and government geologists were lowered into the shaft by cage for a visual inspection of the shaft and main stope area.

The company was also contracted to investigate a potential hazard located below the Cobalt Public School. Test drilling was carried out in August 1988, to determine whether or not a stope was present, and if so, to calculate the thickness and competency of the remaining bedrock. The crown piller was found to be relatively thin in the vicinity of the boiler room and filling of the stope during a school holiday was recommended. The remainder of the area was determined to be safe.

In the same area, a small collapse occurred within a few feet of a house on Chambers Avenue on September 6, 1988. The opening was located between a raise capped in 1964, and a cap of an earlier 1973 collapse. The hole measured approximately 2 m by 1 m by 25 m deep. Agnico–Eagle Mines Limited subsequently capped the hole to Ministry of Labour specifications. On October 1, 1988, heavy rains washed out approximately 1 m of soil between the 1964 cap and the house foundation, exposing a 25 m deep hole. This cap was found to have been placed on overburden on one side rather than on bedrock. Agnico–Eagle Mines Limited removed the overburden to bedrock and extended their September cap to cover the entire 1964 cap up to the foundation of the house. Investigations at this site are continuing.

RESEARCH BY RESIDENT GEOLOGIST'S STAFF

GEOLOGY AND MINERAL POTENTIAL OF BANTING TOWNSHIP AND THE WESTERN PART OF BEST TOWNSHIP

During the 1988 field season, detailed mapping was continued in Banting Township and the western part of adjacent Best Township. Remapping of a number of locations was necessary because of continuing logging operations in much of the area. This logging is accompanied by extensive road–building and clear–cutting operations, which expose considerably more outcrop than normally observed. Publication of an open file report and preliminary geological map is planned for the spring of 1989. This project is funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, and is an extension of a study initiated by Owsiacki in the McLean Lake–Lundy Lake area between 1983 and 1985 (Owsiacki 1984). It was started by M. Smyk (Smyk and Owsiacki 1986) under COMDA and is now being completed by the Resident Geologist.

GEOLOGICAL DATA INVENTORY FOLIOS

The compilation and publication of Geological Data Inventory Folios (GDIFs) was continued during the year under COMDA. Folios and maps for eight townships were completed and published in 1988. In the past 5.5 years, GDIFs for 79 townships have been published, representing 56 percent of the Cobalt Resident Geologist's District. Ten more folios are completed and available for viewing in the office.

DRILL CORE STORAGE PROGRAM

In 1988, 6208 m of core were donated to the Cobalt Drill Core Library by nine companies. This brings

TABLE 14.3. SUMMARY OF DRILLHOLES STORED IN THE COBALT DRILL CORE LIBRARY.

TOWNSHIP	TOTAL HOLES	TOTAL LENGTH (METRES)
Armstrong	1	16.2
Bucke	54	5042.2
Casey	1	82.0
Churchill	2	205.0
Coleman	198	3219.3
Dymond	1	300.4
Firstbrook	22	3107.8
Harley	4	61.8
Harris	9	797.9
Lorrain	11	1196.4
Mattawan	3	377.5
South Lorrain	2	900.9
Strathcona	7	1184.9
Strathy	21	1079.1
TOTAL	231	18291.4

the total footage stored at the facility to 18 291 m. An additional 10 700 m of palletized core is presently stored at the Kirkland Lake Drill Core Library, although the records are now in Cobalt. During the year, new core was collected, and previously stored core was re-arranged and labelled. All drill and borehole core from Golder & Associates' extensive testing of Cobalt mining hazards is also stored at the core library. Table 14.3 provides a township summary of core that is available for viewing, while Figures 14.1a, 14.1b, and 14.1c provide information describing the location of the holes.

RECOMMENDATIONS FOR EXPLORATION

In the Englehart area, the potential for locating gold mineralization in Keewatin volcanic terrain and accompanying granitic intrusions is quite high. According to Johns (1986), all rusty shear zones in metavolcanic rocks, as well as a northeast-trending fault system (the Palmer-Vaughan-Estival break) in Bryce Township and Tudhope Township, should be examined in detail because of the number of good gold showings which occur along these structures. Carbonatized shear zones, especially in the vicinity of Heather, Pike, and Honeymoon lakes, have been prime exploration targets in the past year, and have yielded a number of new gold occurrences, and gold values in soil and basal till sampling. Additionally, an exposure of very coarse, unsorted pyroclastic rocks in the Heather Lake area suggests the possible presence of a volcanic vent within the Archean Skead Group and can be considered a favourable location for the deposition of massive sulphides (Johns 1986). In nearby Dack Township, a fuchsite-bearing carbonatized shear zone at the Hillcrest Property also merits further attention. It closely resembles some of the gold-rich ore zones mined along the Main Break in the Kerr Mine area at Larder Lake-Virginiatown. Extensive clay and sand overburden in this general area has precluded conventional prospecting, but represents a good location for the application of basal till geochemical sampling techniques, and reverse circulation drilling, to locate gold anomalies.

In the Temagami area, many of the older base-metal occurrences are now being explored for platinum group metals (PGM). One such example is the gabbroic Ajax Intrusion at the former copper and nickel producer, the Kanichee Mine. This intrusion hosts moderate values of platinum and palladium within its serpentinized peridotite extensions (Bennett 1978). Similar intensely altered mafic complexes are common throughout this area, and their platinum potential merits further attention.

In the Grenville age rocks of the area, base metals hosted in anorthositic intrusive rocks, silica, mica, kyanite, pegmatites, and building stone are interesting alternatives to precious metal exploration and deserve some consideration.

In the Elk Lake area, the lower contact of a Nipissing diabase sill with Huronian sedimentary sequences and Keewatin metavolcanic rocks is approximately 200 to 250 m below surface. This zone has produced much of the silver in the Gowganda and Cobalt camps and should be considered for potential silver-bearing carbonate vein systems. Many of the former underground silver workings in this area were terminated at a level over 100 m above the lower contact. Deeper diamond drilling of this horizon remains a viable exploration tool for this area.

A new release by the Geological Survey of Canada (Hornbrook and Friske 1988a, 1988b) provides new, lake sediment and water sample analyses for 28 elements over an extensive area covering most of the Cobalt Resident Geologist's District. Numerous new gold anomalies, in addition to anomalies of other elements, provide the basis for more detailed follow-up surveys. The most obvious and interesting of these is located around Wendigo Lake, northeast of Englehart, and is considered to have many features conducive to gold mineralization.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

GEOPHYSICS/GEOCHEMISTRY SECTION

J.E. Hanneson continued a COMDA-funded study in the Cobalt area utilizing electromagnetic surveys to trace Keewatin age, conductive interflow sediments buried below thick deposits of Huronian age sediments. A UTEM (transient electromagnetic) survey was completed over a 4 km² area (Block A) in the McLaren Lake area in Firstbrook and Coleman townships. Preliminary maps illustrating profile data and conductor locations was made available for viewing in December 1988. A gravity survey over this same area was also completed and will be released at a later date. Line cutting was continued and the grid extended in 1988 to cover a further 4 km² area (Block B) adjoining the east boundary of Block A, and 10 km of line was cut (Block C) adjoining the southwestern boundary of Block A. A UTEM survey was also completed over both of these areas and additional surveys will be carried out in 1989.

PRECAMBRIAN GEOLOGY SECTION

P. Born and field assistants continued a multiyear COMDA–funded program in the Temagami–Cobalt area designed to evaluate mineral potential and update the geological data base for townships which were previously mapped in 1926. In 1988, mapping was carried out in Coleman Township and Gillies Limit, south and east of the town of Latchford. The rocks in this area consist predominantly of Archean granites and volcanic units, overlain by Proterozoic sedimentary rocks of the Gowganda and Lorrain formations, all of which are intruded by a Nipissing diabase sill. Several encouraging mineral occurrences were found during this mapping.

J.A. Fyon and assistants continued field work in the Temagami area as part of a multi–year, COMDA–funded investigation of the rocks and mineral occurrences of Strathy, Chambers, Briggs, and Strathcona townships. In 1988, studies were continued describing these occurrences together with host lithologies, stratigraphic and structural characteristics and alteration styles from outcrops located in parts of Briggs and Chambers townships. Base metals, primarily copper, and gold were the most important commodities investigated. Mapping was completed at a scale of 1:8000, with more detailed mapping of outcrops and occurrences being carried out where necessary.

R.J. Rice and D. Watson continued a COMDA–funded study of the sedimentology and paleoplacer gold potential of the Lorrain Formation. The primary objective of this project is to determine whether or not the Lorrain Formation represents a marine or fluvial system and, more importantly, to determine the potential for hosting paleoplacer gold deposits. In 1988, outliers located south and southeast of the main Cobalt Embayment were examined.

D.M. Conrod is investigating Nipissing diabase intrusions over an area extending from Sault Ste. Marie to Cobalt. This project is due for completion in March 1989.

R.M. Easton initiated a geological synthesis of the Grenville Province, with special emphasis on controls in mineralization. One week of mapping was completed in the Tomiko–North Bay area in conjunction with the preparation of a 1:250 000 scale compilation map of the area. A preliminary attempt was made to subdivide this area into a number of lithotectonic domains. Additional work will be required to define these domains in greater detail and to determine the nature of their boundaries.

ENGINEERING AND TERRAIN GEOLOGY SECTION

P.W. Alcock continued a COMDA–funded program of quaternary mapping and till sampling at a reconnaissance scale in the Sinclair Lake area, near Shining Tree. The objectives of the program are to determine the distribution and stratigraphy of quaternary sediments and to expand the geological data base for use in mineral exploration, forestry, and aggregate resource planning. Final field checking of aerial photograph information was carried out in 1988.

GEOSCIENCE LABORATORIES SECTION

P.C. Lightfoot completed a study of the petrogenesis of the Nipissing diabase in the Cobalt area, in co–operation with the University of Toronto and the Mineral Resources Division of the Geological Survey of Canada (Lightfoot and Naldrett, in preparation). Geochemical studies suggest that the variations in mineralization are unrelated to primary igneous processes and that the magmas, which were possibly derived from an old enriched zone of mantle, were virtually uncontaminated by crustal material as they migrated to the surface. There is no indication that the magma carried any silver, copper or other metal, but mobilization of the metals in areas such as Cobalt may have occurred as a result of the diabase emplacement. Uranium–lead dating of baddelyite fractions from two sills carrying the N_1 and N_2 paleomagnetic directions, respectively, revealed a significant difference in ages of emplacement of about 10 Ma.

RESEARCH BY OTHER AGENCIES

GEOLOGICAL SURVEY OF CANADA

P. Frisk, Mineral Resources Division, completed a COMDA–funded regional reconnaissance sampling program of lake sediment and water over a 40 000 km² area encompassing NTS map sheets 41P, 41I, 41H/N1/2, and 31M, to the Quebec border. A total of 3100 sites were sampled. The lake sediments were assayed for 22 elements including gold, and the water was tested for 6 elements. The data for the Cobalt area was released in 1988 (Hornbrook and Friske 1988a, 1988b).

CARLETON UNIVERSITY

D. Marshall initiated a MSc thesis which describes fluid inclusions from silver–arsenide ore veins from samples obtained from the Beaver–Temiskaming, Hellens–Eplett, and Castle silver mines.

K. Venance is carrying out petrographic studies of samples collected in the Little Silver Vein area as part of a BSc thesis project.

LAURENTIAN UNIVERSITY

M.M. Johnston completed a MSc thesis in 1987, entitled "Stratigraphy and Geochemistry of a Portion of the Temagami Greenstone Belt, Northeastern Ontario".

D.J. Brons is investigating the stratigraphy and metamorphism of mafic volcanic rocks in a part of the Temagami greenstone belt as part of a MSc thesis.

R. Nordin is completing research as part of a MSc thesis describing the geochemistry and alteration at the Tyranite gold mine, located in Tyrrell and Knight townships.

McMASTER UNIVERSITY

M. Baknes initiated a MSc thesis describing the geochemistry of an anomalous Archean copper and molybdenite–enriched breccia pipe, located at the contact between mafic volcanic rocks and the Strathy granite batholith near Temagami North (Goward) in Strathy Township. The breccia, consisting of a quartz matrix and volcanic fragments, is relatively unaltered, but contains distinctive zones of feldspathic–rimmed fragments. Field work in 1988 included two months of mapping and sampling. Follow–up chemical analyses will be carried out during the winter and fluid inclusion work may be undertaken at a later date.

UNIVERSITY OF OTTAWA

G.H. Burbidge continued a PhD thesis project investigating the sedimentology of the glaciogenic facies of the Coleman Member of the Gowganda Formation. No field work was undertaken this summer. It is expected that the research will be completed by the fall of 1989.

UNIVERSITY OF WESTERN ONTARIO

J. Aultman completed a BSc study investigating gold dispersal in till, down–ice from a known gold occurrence located near Shining Tree.

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15. Sudbury Resident Geologist's District—1988

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INTRODUCTION

Nickel–copper–precious metal mining by Inco Limited and Falconbridge Limited continued to dominate mining activities in the Sudbury area. High nickel prices throughout the year ensured that both companies made record profits. This has brought renewed optimism to the two companies and to the people of Sudbury.

Falconbridge Limited closed its mill at Falconbridge in February, and announced in July it would sink a 4500–foot deep exploration shaft on the Lindsley Property.

The use of public roads and highways by Falconbridge Limited and Inco Limited, to move increasing amounts of ore and concentrate by trucks to fewer centrally located processing plants, has caused concern within the communities of the Regional Municipality of Sudbury.

Noramco Mining Corporation closed the Golden Rose Mine in Afton Township after only about one year of operation.

The Indusmin Division of Falconbridge Limited continued to produce high–grade silica near Killarney, and Standard Aggregates Incorporated continued to produce high–quality dolostone at the western end of Manitoulin Island.

Kerr Addison Mines Limited restructured, and as a result closed its Sudbury exploration office.

After a major staking rush in 1987 for platinum group elements, claim staking in 1988 was again close to pre–1987 levels.

Drilling outside of the Sudbury Structure was at a low level. Much interest was expressed by companies and individuals in the gold potential of the area. This was based mainly on the observation that an easily recognized albite alteration is associated with many occurrences.

Much interest was expressed by investors in the building stone potential of the district. Prospectors are also beginning to show an interest in building stone.

By the end of November, 29 projects had been approved for assistance available under the Ontario Mineral Exploration Program (OMEP).

MINING ACTIVITIES

THE PRICE OF NICKEL

Nickel prices averaged US$2.21 per pound in 1987. In early 1988, the price began to rise, reaching a peak of US$10.48 per pound on the London Metal Exchange in late March. After that, it dropped gradually, but stayed above US$5.00 for the rest of the year.

By early November, London Metal Exchange warehouse stocks had dropped to 1308 t, a six–year low. High demand came mainly from the stainless–steel industry.

April was an unusual month, with officials from Inco Limited and Falconbridge Limited expressing concern that the price of nickel had gone too high. Substitution was feared.

COMPANY NEWS

Inco Limited and Falconbridge Limited operate internationally, but both companies have their main operations in Sudbury. Whatever happens to the two companies worldwide somehow has an impact on events in Sudbury. For this reason, a few company news highlights from activities remote to Sudbury are included here.

Both companies were highly profitable in 1988, and this improved financial situation lets the two companies—and the Sudbury community—face the future with more optimism than was the case a few years ago.

INCO LIMITED

The high nickel prices during the year resulted in record earnings for Inco Limited of US$516.4 million for the first nine months of 1988, more than ten times higher than the US$50.2 million for the first nine months of 1987.

In 1987, Inco Limited held a 30 percent share of the world nickel market from its worldwide operations. It managed to increase this to 34 percent in 1988. Inco Limited supplied about 20 percent of the western world's nickel from its Sudbury operations.

High earnings also accelerated contract talks in Sudbury. On May 30, Local 6500 of the United Steel Workers of America ratified a new contract calling for a 22 percent wage increase and other benefits over three years. There was no work interruption.

On October 3, Inco Limited announced a controversial measure to prevent hostile takeover bids of the company, even though none was in sight. The plan calls for a US$1.05 billion special dividend to be paid to shareholders, and a special shareholders rights clause to be created which is to come into effect if any one shareholder accumulates more than 20 percent of the stock.

Inco Limited will have to borrow US$500 million to pay the dividend. With that, long–term debt will rise to US$1.4 billion. The investment community is generally opposed to the plan. Inco Limited's shareholders accepted the plan on December 9, 1988.

FALCONBRIDGE LIMITED

Falconbridge Limited reported record earnings for the first nine months of 1988 of $217 million. This compares with $29.9 million in earnings received for the first nine months of 1987.

Toward the end of 1987, Falconbridge Limited got involved in a taxation dispute with the government of the Dominican Republic, where Falconbridge Limited has an 85.2 percent interest in the Falcondo laterite project. The dispute was not resolved until the end of May, 1988. During that period, Falconbridge Limited withheld nickel shipments from the island, and this undoubtedly contributed to shortages and high prices.

In early May, Placer Dome Incorporated offered for sale a 24.7 percent controlling interest in Falconbridge Limited. One interested buyer was Noranda Inc. At the end of June, the Ontario Securities Commission cleared the way for Falconbridge Limited itself to buy the block. Falconbridge Limited, directly and indirectly, paid $960 million, bringing its long term debt to $1.4 billion. No sooner had this deal been completed when Noranda Inc. started to buy Falconbridge Limited's shares on the open market, accumulating 19.99 percent. Noranda Inc. plans to further increase this.

SUMMARY OF MINING ACTIVITIES

Production of nickel, copper, and precious metals by Inco Limited and Falconbridge Limited continued to dominate mining activities in the area. In Scadding Township, Orofino Resources Limited mined the Intermediate Zone at the Scadding Mine for gold and milled the stockpiled ore. Noramco Mining Corporation operated the Golden Rose gold mine in Afton Township until early September, and then closed it. The Indusmin Division of Falconbridge Limited continued to quarry high–grade silica near Killarney, and Standard Aggregates Incorporated continued to quarry dolostone on Manitoulin Island. Carman Construction Inc. shipped silica flux from Alban to Copper Cliff. Sand and gravel were produced from many small pits.

NICKEL–COPPER–PRECIOUS METALS MINING

Inco Limited

Inco Limited operated nine underground mines, three mills, one smelter, two refineries, and one strip rolling mill. The company employed about 7900 persons within the Sudbury area throughout 1988.

Despite high nickel prices, Inco Limited shut down its Sudbury operations for five weeks, from June 27 to August 1.

The Garson Mine underground workings remained closed, but toward the end of 1988, the company was preparing an open pit for production. At the annual meeting, company officials hinted that the Garson Mine would eventually reopen, but not before 1991.

On August 4, Inco Limited announced that it would consolidate all milling operations in an expanded Clarabelle mill. The Frood–Stobie mill will close, and the Copper Cliff mill will, in the future, only handle dewatering of concentrates. The change will take two and a half years to complete, at a cost of $69 million.

The change will allow the company to cut sulphur dioxide emissions by about 100 000 t per year. This will be achieved by improved magnetic separation of pyrrhotite.

The company also announced, on August 4, that it would spend $19.6 million to expand the tailings impoundment area.

On October 4, company officials stated that Inco Limited would spend between $250 and $300 million to meet the government's 1994 sulphur dioxide emission standards in Sudbury. Current emission levels are 685 000 t per year; by January 1, 1994, this will have to be reduced to 265 000 t per year.

Falconbridge Limited

Falconbridge Limited produced from six underground mines and one open pit mine. The company increased employment in the Sudbury area in 1988 from 2250 to 2400 persons.

The company shut down production for three weeks, from July 3 to July 23.

In February, Falconbridge Limited closed the mill at the Falconbridge Mine. Forty–five workers were assigned to other duties. Ore from the East Mine and Falconbridge Mine openpit was trucked to the Strathcona mill. The Falconbridge mill was closed in anticipation of the East Mine closing in mid–1988. When nickel prices rose, closure of the East Mine was postponed to late 1988, and now is postponed to late 1989.

During the year, Falconbridge Limited explored the Craig orebody from drifts on the 2000–, 3000–, and 4000-foot levels driven from the nearby Onaping Mine. Early in the year, Falconbridge Limited said that 20 million tons reserve would be needed to consider a new surface shaft; by year's end this had not been announced.

On July 19, Falconbridge announced it would sink the T.L. Exploration Shaft on the Lindsley Property, in Blezard Township, to explore four copper-nickel-precious metal zones occurring below 4000 feet. These had been discovered and explored by surface drilling in 1987. The shaft is to be 16 feet in diameter, 4500 feet deep, and will have an exploration drift on the 4300-foot level. Cost over four years will be $32.6 million.

THE TRUCKING ISSUE

Ongoing consolidation of surface operations into fewer central plants, by Falconbridge Limited and Inco Limited, and shifting from rail to road transportation, has resulted in an increase in the number of heavy trucks on regional roads and city streets. Trucks move ore to mills, and concentrate from mills to smelters.

The two companies are fully within their right to do so, but the ever larger number of trucks is causing concern: traffic safety and damage to road surfaces are the issues.

A fatal accident on September 13, involving a truck carrying slurry, under contract to Falconbridge Limited, brought the issue to the forefront again. The general public, labour leaders, and local politicians began calling for alternate routes, a new bypass, or a return to rail transportation. By the end of 1988, the issue remained unresolved.

RECOGNITION OF SUDBURY MINING

In November, the "Discovery Site" at Inco Limited's Murray Mine was designated a Historical Landmark by ASM International (formerly American Society for Metals). A plaque has been erected at the site. This recognizes Sudbury, and the copper-nickel ores, as having played a major role in man's use of metals. Only 57 other sites worldwide have been so recognized.

GOLD MINING

Orofino Resources Limited mined out the Intermediate Zone on its Scadding Township property in February. Reserves were about 120 000 tons at 0.22 ounce gold per ton. The ore was stockpiled on surface, and treated during the year. The mill handled about 170 tons per day. Concentrate was shipped to the Horne Smelter at Noranda, Quebec. Production for 1988 was 4680 ounces of gold. The stockpile will allow operations to continue until mid-1990.

Noramco Mining Corporation experienced difficulties at the Golden Rose Mine with production, grades, and recovery. The mine was only opened in 1987. In September the company closed the mine temporarily to gain time to make adjustments to the mill, and to ramp to lower levels where diamond drilling had indicated higher-grade ore. In November, the company announced that the mine will not reopen. The closure affected about 120 persons.

INDUSTRIAL MINERALS PRODUCTION

Standard Aggregates Incorporated continued to operate the Meldrum Bay dolostone quarry during the Great Lakes shipping season. The quarry is at the western end of Manitoulin Island. The company quarries a 50-foot high face in the Silurian Amabel Formation. Production for 1988 was expected to be about 1.7 million tons, similar to last year's production. The company produces 12 size grades, which are shipped in lake freighters to destinations in southern Ontario and the United States. The company has ordered equipment to increase production, in stages, to about 3 million tons.

The Indusmin Division of Falconbridge Limited operated its Badgeley Island silica quarry during the Great Lakes shipping season. The quarry is 4 km west of Killarney. Production for 1988 was 480 000 tons. The coarse silica is shipped to Midland, Ontario, and other Great Lakes ports for further treatment.

Carman Construction Inc. of Sudbury shipped 700 tons of white vein quartz from Truman Township to the province of New Brunswick. The material was used for precast concrete building panel facing for the Boston market. Carman Construction Inc. also sent 120 000 tons of silica flux to Inco Limited, at Copper Cliff, from its Alban quarry.

EXPLORATION ACTIVITIES

The Sudbury Resident Geologist's District encompasses about 27 500 km^2 (Figure 15.1.). Geologically, the district is underlain by Proterozoic, Paleozoic and Archean age rocks.

Paleozoic age rocks comprise Ordovician and Silurian, marine sedimentary rocks occurring on Manitoulin Island, and several smaller islands within Georgian Bay and the North Channel of Lake Huron. These underlie about 18 percent of the district.

Some 51 percent of the district is underlain by Proterozoic rocks of the Grenville Province, the Sudbury Igneous Complex and Whitewater Group, and the Southern Province.

Almost 22 percent of the area belongs to the Grenville Front Tectonic Zone and the Metasedimentary Gneiss Belt. Within the district, 160 km of the Grenville Front can be found.

The Sudbury Igneous Complex, and the Whitewater Group which lies within it, constitute about four percent of the district.

The Southern Province includes clastic and chemical sedimentary and volcanic rocks of the

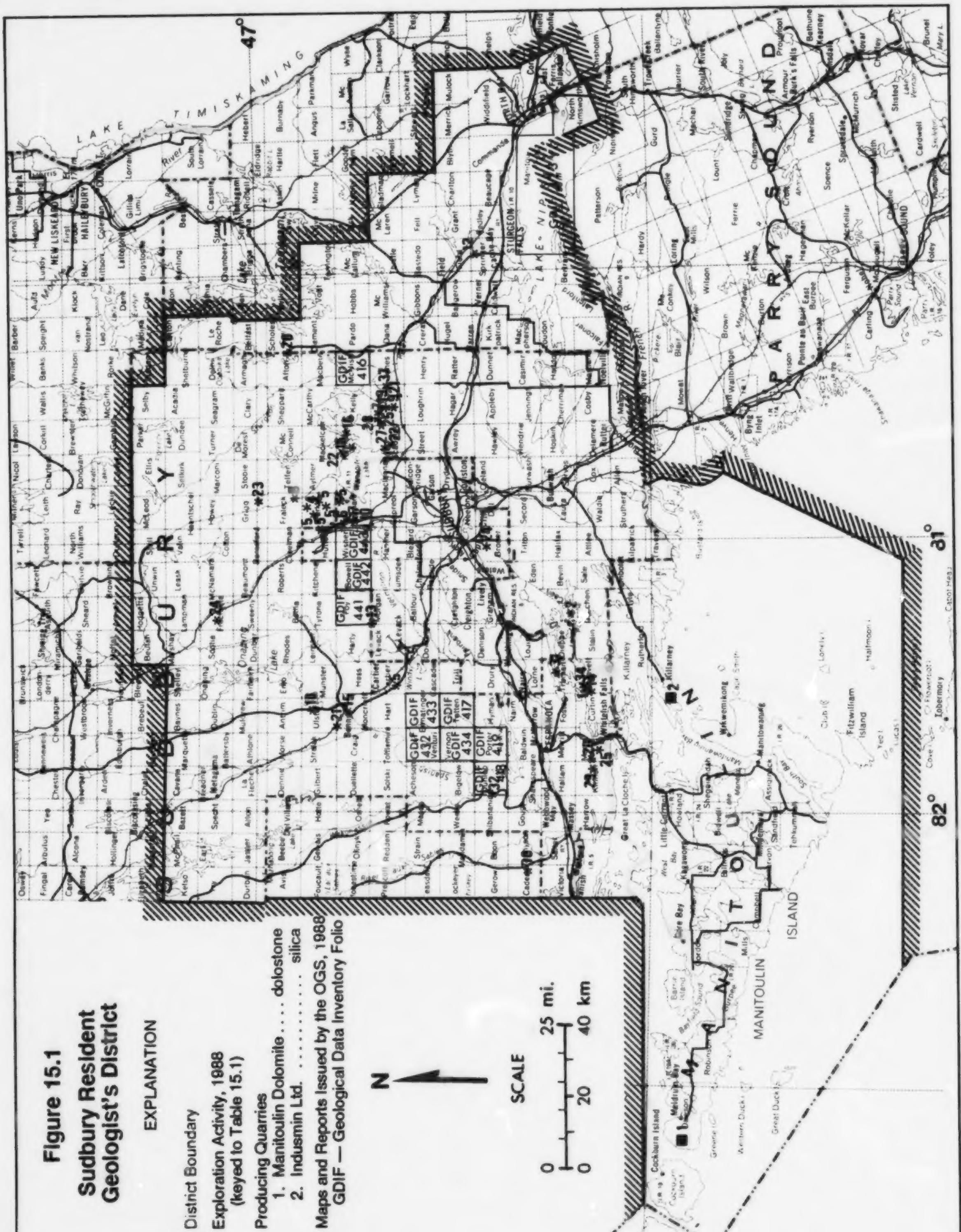

Figure 15.1
Sudbury Resident Geologist's District

EXPLANATION
▨ District Boundary
* Exploration Activity, 1988 (keyed to Table 15.1)
■ Producing Quarries
1. Manitoulin Dolomite .... dolostone
2. Indusmin Ltd. .... silica
☐ Maps and Reports Issued by the OGS, 1988
GDIF — Geological Data Inventory Folio
N
SCALE
0 25 mi.
0 20 40 km
47°
82°
81°
LAKE TIMISKAMING
NEW LISKEARD
HAILEYBURY
SUDBURY
PARRY SOUND
MANITOULIN ISLAND
DRUMMOND ISLAND
Cockburn Island
Killarney
Fitzwilliam Island
Tobermory
STURGEON FALLS
LAKE NIPISSING
NORTH BAY
GDIF 416
GDIF 441
GDIF 442
GDIF 432
GDIF 433
GDIF 434
GDIF 417
GDIF 418
GDIF 419

TABLE 15.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Allard, John	Stripping and trenching
2	Blue, D. R.	Stripping, sampling and trenching
3	B. P. Resources Canada Ltd.	Airborne Geophysics
4	Boulard, Victor	Trenching
5	Brady, John	Assaying, sampling
	Brady, John	Stripping and trenching
	Brady, John	Trenching
6	Brady, Linda	Trenching
7	Brady, Marie	Trenching
8	Brady, Robert	Trenching
9	Bradley, J. D.	Geology, Stripping, and trenching
10	Brown, Donna	Trenching
11	Charron, Reginald	Geology, Geophysics and Geochemistry
12	Concentrated Rare Earth Minerals Ltd.	Geology and Geophysics
13	Crimsonstar Resources Ltd.	Diamond Drilling
14	Elliot, Art	Geophysics and Stripping
15	Falconbridge Ltd.	Airborne Geophysics
	Falconbridge Ltd.	Stripping, Trenching and Assaying
16	Flag Resources (1985) Ltd.	Diamond Drilling
17	Gaudette, Gerald	Trenching
18	Gervais, John Claude	Stripping and trenching
19	Guiding Resources Ltd.	Airborne Geophysics
20	Hardiman Bay Resources Inc.	Geological Mapping
21	Imperial Metals Corp.	Geochemistry and Geology
22	Jerome, A. E.	Airborne Geophysics, Geochemistry, Geology, Geophysics and Stripping
23	Mainville, Clem	Diamond Drilling, Stripping and trenching
24	Midas Minerals Inc.	Geophysics
24	Midas Minerals Inc.	Diamond Drilling
25	Mill City Gold Inc.	Geophysics, Stripping and trenching
	Mill City Gold Inc.	Geophysics
26	Noramco Mining Corp.	Diamond Drilling
27	Pelangio-Larder Mines Ltd.	Diamond Drilling
28	Plexman, Eric	Stripping
29	Rainbow Exploration Corp.	Trenching and stripping
30	Richie, Gerald and Ward, Mai	Stripping and Drilling
31	Salo, Gordon	Stripping and trenching
32	Stewart, Richard	Geophysical and Geochemical
33	Vanlith, George	Trenching
34	White, James	Stripping and trenching

TABLE 15.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	893	1780	7821	21,303	255,824	8746	304,792
1987	5777	720	9358	16,266	43,721	3467	77,041
1986	1191	1171	4396	22,017	14,350	1658	49,820
1985	1079	1297	4358	25,873	56,894	1717	94,541
1984	1451	1520	4508	49,516	23,652	3541	83,045

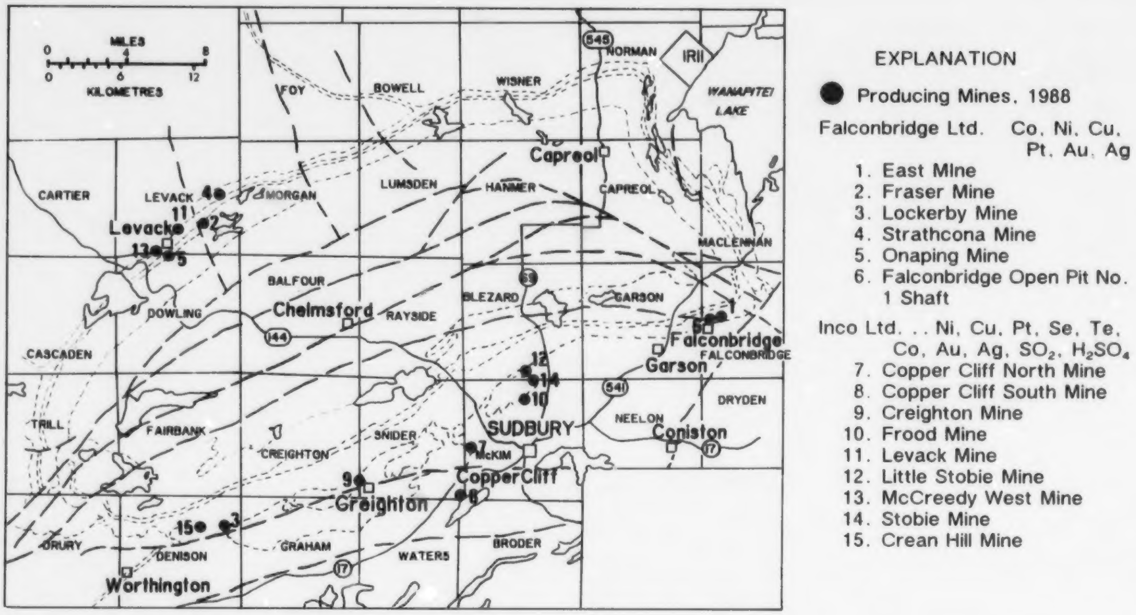
MILES
0
4
8
0
6
12
KILOMETRES
FOY
BOWELL
WISNER
NORMAN
IRII
WANAPITEI LAKE
Capreol
CARTIER
LEVACK
MORGAN
LUMSDEN
HANMER
CAPREOL
Levack
MACLENNAN
BALFOUR
Chelmsford
RAYSIDE
BLEZARD
GARSON
DOWLING
Falconbridge
FALCONBRIDGE
CASCADEN
Garson
DRYDEN
TRILL
FAIRBANK
SNIDER
SUDBURY
NEELON
Coniston
CREIGHTON
McKIM
Copper Cliff
Creighton
DRURY
DENISON
GRAHAM
WATERS
BRODER
Worthington
545
55
144
541
17
EXPLANATION
● Producing Mines, 1988
Falconbridge Ltd. Co, Ni, Cu, Pt, Au, Ag
1. East Mine
2. Fraser Mine
3. Lockerby Mine
4. Strathcona Mine
5. Onaping Mine
6. Falconbridge Open Pit No. 1 Shaft
Inco Ltd. . . Ni, Cu, Pt, Se, Te, Co, Au, Ag, SO₂, H₂SO₄
7. Copper Cliff North Mine
8. Copper Cliff South Mine
9. Creighton Mine
10. Frood Mine
11. Levack Mine
12. Little Stobie Mine
13. McCreedy West Mine
14. Stobie Mine
15. Crean Hill Mine

Figure 15.2. *Producing mines, and commodities, Sudbury mining camp.*

Huronian Supergroup, and Nipissing diabases; it underlies about 25 percent of the district.

Archean granites, gneisses, and greenstones (volcanic–sedimentary belts) of the Superior Province underlie about 31 percent of the district. Unfortunately, few greenstone belts occur in the district, the ratio of granite to volcanic–sedimentary rock being about 20:1.

Glacial till and postglacial organic matter cover much of the bedrock.

The area is well known for its large nickel–copper–precious metal mines, which are associated with the Sudbury Igneous Complex, many precious and base–metal occurrences outside the Sudbury Igneous Complex, and numerous enigmatic geological features. These draw many companies, prospectors, and visitors to the area each year.

In 1988, 893 newly staked claims were recorded. This is down from the year before, when a major staking rush took place, but is close to the level of activity that existed in the years before 1987.

The staking rush in 1987 was started by BP Resources Canada Limited. The other major participants were Inco Limited, Falconbridge Limited, and Kidd Creek Mines Limited. The staking covered almost all of the gabbros around the Sudbury Structure which contain known nickel–copper showings. The purpose of the staking was to test these showings, and the gabbro bodies, in general, for platinum group elements. By the end of 1987, 5777 claims had been staked.

Exploration activity in 1988 reflected the staking of the year before. In terms of days of assessment work submitted, 1988 was a busy year. However, numbers can be deceptive; by year end 304 792 days of work had been submitted, of which only 21 303 days (seven percent) were for diamond drilling. In order to hold onto the large tracts of land staked in 1987, companies resorted to blanket airborne geophysical surveys, and these account for most of the work.

In 1988, the federal government began to phase out flow through share financing, and announced the Canadian Exploration Incentive Program (CEIP), which came into effect on January 1, 1989. Much uncertainty accompanied these changes, and this has had a detrimental effect on exploration activity, certainly where it counts most—diamond drilling.

Falconbridge Limited and Inco Limited continued to explore their properties in the Sudbury area. Falconbridge Limited took out work permits to include diamond drilling in Blezard, Levack, Balfour, Dowling, Morgan, Denison, and Graham townships, and Inco Limited undertook the same in Blezard, Denison, Drury, Trill, Garson, Dill, and Levack townships. The work took place on patented land, and few details are known to this office.

Companies and individuals who were active in the Sudbury area carried out a variety of programs.

KERR ADDISON MINES LIMITED

Kerr Addison Mines Limited restructured the company, and in September closed its exploration office in Sudbury.

BP RESOURCES CANADA LIMITED, Mining Division

BP Resources Canada Limited did groundwork on selected areas of their extensive claim holdings staked in 1987. The company cut grids, carried out geological mapping, conducted IP surveys, and undertook surface sampling. More work is planned for 1989.

HARDIMAN BAY RESOURCES INC.

Hardiman Bay Resources Inc. optioned a property from Dan Brunné and Associates in Mongowin Township. The property is underlain by the Serpent and Espanola formations, which are intruded by an ultramafic plug and cut by a quartz–carbonate vein. Hardiman Bay Resources Inc. examined the vein for its silica flux potential, but did not come up with favourable results. Gold values of 0.02 ounce per ton are common on the property, with past results of over one ounce of gold per ton having been obtained from a grab sample taken close to the ultramafic intrusion. More detailed exploration near the ultramafic intrusion should be done.

ART ELLIOT EXPLORATION

Art Elliot of Art Elliot Exploration, London, Ontario, continued work on his Curtin and Roosevelt townships property. He has obtained permission from the Ministry of The Environment to set up a small–scale mill to concentrate ore on the site. In preparation, much of the ore was hand cobbed this summer. Tests indicate he will be able to achieve a concentrate containing 10 ounces gold per ton.

R. STRINGER

R. Stringer, a prospector from Sudbury, carried out geological mapping, airborne electromagnetic (EM) and magnetic surveys, and sampling on a nine–claim property in Curtin Township. Several grab samples of disseminated sulphides within gabbro analyzed at over 1000 ppb combined gold, platinum, and palladium, the best being 5160 ppb. The breakdown of the last analysis is as follows: 850 ppb gold, 3120 ppb platinum, 1190 ppb palladium.

G. SALO

G. Salo, a Sudbury area prospector, continued exploration on his Truman Township property this year. He sank a shallow shaft through overburden into the bedrock on a magnetic anomaly. He uncovered a sulphide vein which cuts the Espanola Formation. The shaft did not go through the vein so its thickness is unknown. Alteration around the vein appears to be soda metasomatism. A more detailed study will be conducted next summer by this office on the property and on a few others of a similar nature in the area.

INCO LIMITED

Inco Limited mapped a narrow belt of ground in Tyrone, Botha, and Sweeny townships. The purpose was to look for extensions of the Foy offset dike. The company conducted VLF–EM and magnetic surveys. A planned drilling program was postponed to 1989.

FALCONBRIDGE LIMITED

Falconbridge Limited drilled three holes, totalling 1166 m, for base metals within the Benny greenstone belt in Moncrieff Township. Nothing of economic significance was found.

H.J. TRACANELLI

H.J. Tracanelli, Exploration Geologist, Sudbury, conducted a reconnaissance geological survey and trenching program on several northeast–trending quartz–carbonate veins in Ulster Township. The property is traversed by Highway 144. Grab samples from the veins have yielded some values in the 0.2 ounce gold per ton range, but there has been difficulty repeating copper values of 1.0 to 1.5 percent obtained earlier. The main type of mineralization is pyrite and chalcopyrite, with reported inclusions of magnetite in the quartz veins. The veins are up to 28 cm wide and occur in a zone about 7.5 m wide.

H. Tracanelli plans to conduct electromagnetic and magnetic surveys over the property this winter, and plans to continue his exploration program next summer.

UNITED REEF PETROLEUMS LIMITED

United Reef Petroleums Limited continued work on the Foy offset dike in Foy and Bowell townships. The company drilled nine holes totalling 4825 feet (1471 m). The best intersections were obtained in "Area 1", along the eastern boundary of Foy Township. Hole 66 intersected 1.448 percent copper, 0.121 percent nickel, 0.047 ounce platinum per ton, and 0.012 ounce palladium per ton from 395.0 feet to 405.0 feet; and 13.88 percent copper, 3.07 percent nickel, 0.043 ounce platinum per ton, 0.018 ounce palladium per ton, and 0.092 ounce gold per ton from 469.0 feet to 475.5 feet. Hole 68 intersected 11.95 percent copper, 0.656 percent nickel, 0.035 ounce platinum per ton, and 0.044 ounce palladium per ton from 267.8 feet to 269.5 feet; and 19.84 percent copper, 0.265 percent nickel, 0.019 ounce platinum per ton, and 0.020 ounce palladium per ton from 354.7 feet to 357.0 feet. The company also conducted downhole electromagnetic [EM–37] surveys.

IMPERIAL METALS CORPORATION

Imperial Metals Corporation worked on five properties in the Sudbury area, mostly under option from J. Brady, a Sudbury prospector. The company did not drill any of the properties.

In the Straight Lake area of Ulster and Moncrieff townships, the company held six claims. The company cut a grid, carried out geological mapping, a magnetic survey, and soil sampling. A magnetic horizon crossing the property is thought to be the same as the one carrying the Stralak zinc deposit to the west. The property was returned to J. Brady.

In the Banagan Lake area of Hutton Township, Imperial Metals Corporation held 20 claims. Here the company was looking for a bedrock source for the placer gold of the Vermilion River. The company cut a grid and carried out geological mapping and soil sampling. Anomalous soil values were obtained, and more work is to be done.

In north-central Hutton Township, the company examined three claims with a soil-sampling program. The target here was gold in Huronian sediments. The program was not successful.

In Parkin Township, Imperial Metals Corporation worked on 19 claims, which cover Archean mafic and felsic volcanic rocks, and iron formations. A total of 800 soil samples were collected, some yielding up to 650 ppb gold. The company is sufficiently encouraged to continue work on the property.

In Davis Township, the company held ground south and east of the recently mined-out Norstar Mine. A 900-sample humus-sampling survey yielded discrete anomalies.

PROPHET RESOURCES LIMITED

Prophet Resources Limited worked on a 32-claim property in Parkin Township. The company carried out a mapping program and VLF-EM and magnetic surveys over most of the property, and did trenching and percussion drilling on the Parkin offset dike on claims S.693958 and S.693959, south of the Jon Smith Mine.

In December, the company announced the results of four holes. The best platinum and gold values occur in hole 88-08, in which a 10-foot section assayed 1.1 percent copper, 1.5 percent nickel, 0.08 ounce platinum per ton, 0.05 ounce palladium per ton, and 0.04 ounce gold per ton.

NORAMCO EXPLORATIONS INC.

Noramco Explorations Inc. drilled one 140 m hole on a 21-claim property in Falconbridge Township. The hole intersected the Norduna Fault, the target of the hole. The company also carried out a humus-sampling survey across three claims traversed by the Norduna Fault, and assayed for platinum, palladium, gold, copper, nickel, cobalt, and chromium. The drillhole was completed on December 7, so that at the time of writing of this report no results were available.

Company plans called for three holes, of 180 m each, to be drilled on their property in Morgan Township during December, 1988.

NORTH COAST INDUSTRIES LTD.

North Coast Industries Ltd. completed a program, which included diamond drilling and induced polarization (IP) surveying, on ground in MacKelcan Township that Hecla Mining Company of Canada Limited had optioned from Flag Resources (1985) Limited. Thirteen holes, totalling 1402 m, were drilled. Flag Resources (1985) Limited released results, in November, of 12 intersections from seven of the eight holes drilled in the upper Jess Lake zone. Values range from a low of 0.081 ounce gold per ton over 6.1 m to a high of 0.395 ounce gold per ton over 5.5 m. One hole, testing a known, deeper gold horizon, intersected 0.121 ounce gold per ton over 18 m from the interval 215 to 233 m.

Consulting Geologist, F. Tagliamonte, has recommended that tonnage and grade calculations be made, and that the deposit be bulk sampled.

Four drillholes were also sited on induced polarization (IP) anomolies occurring south of Jess Lake.

FLAG RESOURCES (1985) LIMITED

Flag Resouces (1985) Limited drilled about 610 m, distributed among three drillholes, south of Rathbun Lake in Rathbun Township. The program was aimed at testing the downdip extensions of a nickel-copper-platinum occurrence, at the southern end of the lake. The program was not successful.

JARVIS RESOURCES LIMITED

Jarvis Resources Limited, under an option agreement with A. Hazlett, Toronto, dewatered the shaft on the old Red Rock Property in Scadding Township. Massive carbonate-quartz veins occur in a complex sheet system within a large northwest-trending gabbro. The shaft was sunk, in 1925, to a depth of about 50 m, and 347 m of lateral work was completed on the 30 m level.

Results were disappointing, and the property has been returned to A. Hazlett.

ORECO MINES AND ENERGY CORPORATION

J.E. Tilsley and Associates Ltd. completed a program of geological, geophysical, and geochemical surveys, for Oreco Mines and Energy Corporation, in Scadding Township. Stripping over a 750 m^2 area has exposed an outcrop of flow-banded Sudbury breccia, which has been albitized and, in part, mineralized with pyrite. At the end of 1988, ther claims were recorded in the name of A.E. Jerome of Hanmer.

WAHNA GOLD RESOURCES LIMITED

Wahna Gold Resources Limited drilled about 1005 m, distributed among 20 drillholes, on their property in Maclennan Township. Gold associated with massive sulphides accompanies albite alteration within narrow shears and fractures in Mississagi Formation arkose. No assay results from this program are available.

CAN-MAC EXPLORATION LIMITED

CAN-MAC Exploration Limited holds about 70 claims in Davis Township. The company did extensive stripping and drilling on a system of gold-bearing quartz veins in 1986 and 1987. In 1988, the company carried out an airborne geophysical survey.

676577 ONTARIO LIMITED

In 1987, Wm. Klenk, of Manitowaning, incorporated 676577 Ontario Limited. In 1988, the company obtained a Bucyrus Erie 29 T drill rig. Plans are to deepen an 825-foot well at Sandfield to pre-Paleozoic basement in search for oil and brines, and to drill new holes in the Tehkummah area.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

STAFF

Staff working out of the Resident Geologist's Office in 1988, carried out the following functions:

1. P.E. Giblin, Manager, Mineral Resources, Northeastern Region
2. W. Meyer, Resident Geologist
3. R.W. Campbell, Staff Geologist
4. T.L. Livingstone, Secretary to the Manager, and part-time Secretary to the Resident Geologist
5. T.L. Hughes, Secretary to the Manager, and part-time Secretary to the Resident Geologist (Hughes temporarily replaced Livingstone, beginning in August)
6. L.B. Jerome worked on contract on Geological Data Inventory Folios (GDIFs)
7. B.I. Gates continued to work on the Sudbury Mineral Occurrence Study
8. J.K. Lacey worked on Geological Data Information Folios (GDIFs) from January to March, and on the Sudbury Building Stone Study from April to December
9. R.J. Henri joined the staff as field assistant in June; during the summer and fall he assisted B.I. Gates, and in late fall he worked with J.K. Lacey
10. M. Lamacraft assisted J.K. Lacey, from June to the end of August, under the Experience '88 Program

OFFICE RELOCATION

In April, the Sudbury offices of the Mines and Minerals Division (Manager, Mineral Resources; Resident Geologist; Mining Recorder) relocated to the West Tower of the Sudbury Civic Square. The new address is as follows:

Bag 3000
200 Brady Street
6th Floor
Sudbury P3A 5W2
Telephone (705) 675-4441
FAX 705-675-6473

ACTIVITIES

Staff of the Resident Geologist's office responded to approximately 430 enquiries about assessment work, the geology of the area, mineral occurrences, mineral potential, conceptual ideas, government programs, and rock and mineral identification. Staff visited properties, and discussed problems with property owners in the field.

An invitation, in January, to talk about Sudbury geology and mining to the Grade 13 geography class at Lockerby Composite School was received at the Resident Geologist's office from a teacher who had taken part in the 1987 Ontario Mining Association's tour of northern Ontario. W. Meyer and R.W. Campbell gave the talk.

B.I. Gates gave a talk on mineral occurrences occurring east of Wanapitei Lake and presented a poster and samples display at the Ministry of Northern Development and Mines' open house in Timmins, in February.

In April and May, R.W. Campbell and W. Meyer offered an 18-hour introductory prospecting course for the public. This course was three hours longer than the classes which were run in 1987. Of the 30 persons registered, 21 completed the course. The response has, once again, been good, and we plan to offer the course again early in 1989.

A group of four Jamaican government geologists visited Sudbury in May as guests of the Ministry of Northern Development and Mines. They toured the Indusmin Division's Badgeley Island silica quarry, building stone prospects near Bell Lake, and Inco Limited's McCreedy West Mine.

A Boy Scout troop from the Long Lake area visited the office in May, wanting to see local minerals and rocks, hear about Sudbury geology, and learn how a government office functions.

In May, L.B. Jerome took part in a two-day workshop for about 100 girls at Cambrian College entitled "Girls Growing Up". L.B. Jerome talked about women in nontraditional professions (geology in her case), and showed the girls how to pan for gold (successfully).

In our ongoing effort to understand the Sudbury mines, staff visited Inco Limited's Frood Mine and

Falconbridge Limited's East Mine. Accompanying out-of-town visitors, W. Meyer also visited Inco Limited's McCreedy West Mine and South Mine, and Falconbridge Limited's Fraser Mine. Our thanks go to the management of the two companies and their staff for very informative tours.

In July, our office participated with a display booth at the sixth Annual Sudbury Gem and Mineral Show.

Four groups of visitors were taken on geology tours of the Sudbury Structure during the summer.

W. Meyer gave geology talks to Junior Rangers at the Ministry of Natural Resources Fort LaCloche camp, and spent one day at Killarney Provincial Park accompanying tourists on hikes and canoe trips.

In August, R.W. Campbell talked to a group of Sudbury area students about Sudbury geology and mining as part of their orientation before going to Ontario Place in Toronto to act as hosts at the Ontario North Now Pavilion for a week.

In September, R.W. Campbell and W. Meyer took a group of geography teachers on a Ministry of Northern Development and Mines sponsored one-hour aerial tour of the Sudbury mining areas. This has been an annual event for several years. The tour is organized by Bruce Campbell, Manager, Technical Services, Ontario Mining Association (OMA). Each year it offers 35 to 40 geography teachers, primarily from southern Ontario, the opportunity to tour northern Ontario mining communities for one week. The aerial tour is part of this program. The response has been good every year. The teachers feel they are getting a better understanding of northern Ontario, an understanding they pass on to their students. Over the years, more than 400 teachers have made the trip.

Two years ago we prepared an audiovisual presentation of the aerial tour. In 1988, the Ministry of Northern Development and Mines' Communications Services Branch completed final editing and professional narration. The presentation was shown at the December, 1988, Ontario Mines and Minerals Symposium, in Toronto. It can be borrowed from this office.

On October 17 and 18, R.W. Campbell and J.K. Lacey organized a tour of potential building stone sites in the area for Ministry of Northern Development and Mines' staff. The tour showed that areas of relatively unfractured rocks which would yield building stone of attractive colour and texture can be found around Sudbury.

In October, R.W. Campbell took a three-day training course to become an instructor for the new federal Workplace Hazardous Materials Information System (WHMIS; "The Right to Know" legislation). In late 1988 and early 1989, he instructed ministry staff of the Northeastern Region registered in the program.

B.I. Gates and J.K. Lacey participated with poster and sample displays at the Ontario Mines and Minerals Symposium, in Toronto, in December.

W. Meyer served on the Astrosphere working committee at Science North, and R.W. Campbell served on the Geosphere working committee.

RESEARCH BY RESIDENT OFFICE STAFF

SUDBURY MINERAL OCCURRENCE STUDY

by B.I. Gates

This was the second year Project A.4.7., funded by the Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. Its purpose is to investigate known mineral occurrences in the Wanapitei Lake area, to the northeast of Sudbury. Detailed geological maps were made for several properties, initially discovered in the late 1800s, and where a reinterpretation of the geology was necessary. Assistance during the summer and fall was provided by R.J. Henri.

The area is underlain by sedimentary rocks of the Huronian Supergroup which have been intruded by Nipissing Diabase sills, dikes, and irregular bodies. Mineralization in the area consists of gold and gold-copper occurrences, within sedimentary rocks and gabbro, and nickel-copper-platinum group element occurrences within gabbro. The latter appear to be limited in extent, and are associated with prominent jointing.

Most gold showings are directly related to soda metasomatism (*see* Meyer *et al.* 1987, p.256). Sodium- and carbonate-rich solutions, migrating along zones of weakness, may have leached a variety of metals from the host rocks; subsequently, these transported metals may have concentrated in favourable sites, forming economic orebodies.

Geochemical analyses of samples taken, in 1987, of mineralization associated with albitized rocks show anomalous values in gold, arsenic, cobalt, copper, and nickel. Six samples analyzed for platinum and palladium all returned values of <1 ppb. However, numerous samples of albite alteration were observed on the muck pile at the platinum-rich Rathbun Lake Occurrence.

There have been three operating mines in the area, and each represents a different style of mineralization.

At Orofino Resources Limited's Scadding gold mine, completely albitized rocks of the Espanola and Serpent formations are fractured and flooded by chlorite. Gold is associated with sulphides within the chlorite-rich zones. Arsenopyrite is the dominant sulphide in the near–surface zones mined by open-pit, while pyrite mineralization hosted the gold in the larger, underground Intermediate zone.

The Norstar Mine is a copper–gold occurrence in Davis Township. Gowganda Formation argillite and wacke are brecciated and flooded by quartz–carbonate veins containing, occasionally, massive arsenopyrite, chalcopyrite, and pyrite. The pipe-shaped breccia was mined to the 96 m level in 1986. The structure continues at depth, but was reported as noneconomic. Tan–coloured, albitized wacke, as well as albitic reaction rims around breccia clasts, were observed in samples from waste dumps.

At the Crystal Mine in Rathbun Township, gold occurs in the free state within narrow quartz–carbonate veins. The veins are located within strongly albitized sedimentary rocks, or in gabbro accompanied by a distinct alteration halo. A brief description of this property follows later in this report.

The development of ankerite rhombohedra, often associated with soda metasomatism, is an easily recognizable indicator. Quartz veins, with narrow albitized halos, were observed in many areas with ankerite rhombs developed at a distance from the veins in rocks which appear otherwise unaltered. Ankerite rhombs were also seen within the Sudbury Breccia, in the Crystal Mine area. Recent stripping in Scadding Township, done for Oreco Mines and Energy Corporation, has uncovered Sudbury Breccia wherein both clasts and flow–banded matrix are albitized. This would date the soda metasomatism at an age younger than 1850 Ma—the age for the Sudbury event—and much younger still than the Nipissing intrusions which are dated at 2100 Ma. The Nipissing intrusions were long thought of as being responsible for the mineralization in the area. It is possible then that soda metasomatism may have affected the Sudbury Igneous Complex and the older Archean rocks in the area.

Bonanza Lake

This property, located in Maclennan Township (UTM co–ordinates 5168200N, 522300E), was discovered in 1888 as the Mammoth Vein, and was explored by the Bonanza Nickel Mining Company. Values of $100 per ton gold were reported, with gold valued at US$20 per ounce, and several shallow shafts were put down. The property was used as the second test site for the Ontario government's diamond drill in 1895, at which time 296 feet of core were drilled in two holes at a rate of 4 feet and 3 inches per day at a cost of $4.32 per foot. The property has subsequently been explored as a source of silica flux and as aggregate.

A lens of 60 percent quartz and 40 percent ankerite is located within a larger albite–alteration zone in Nipissing Diabase. Striking 315° and dipping 85° northeast, the zone is from 10 to 25 m wide and 750 m long. It disappears beneath water at both ends. The quartz–ankerite lens, which is 250 m long, has a 10 cm wide contact zone that appears to be a plagioclase–carbonate–rich alteration of the gabbro. Minor brecciation of the gabbro occurs in several locations.

The northernmost 200 m of the zone consists of albite and ankerite without a quartz–carbonate core. Brecciated, it occasionally appears as though the albite and ankerite are replacing the matrix and clasts of a Sudbury Breccia.

Narrow, carbonate–rich, siliceous–looking shear zones, up to 30 cm wide and also striking at 315°, are located up to 50 m away within the enclosing gabbro.

Only minor pyrite was noted associated with the albite. Samples of unmineralized quartz and ankerite analyzed <2 ppb for gold and silver.

Crystal and Comstock Mines

Located in Rathbun Township (UTM co–ordinates 5177700N, 528800E) the Crystal Mine was discovered in 1892 and saw limited gold production during the periods 1895 to 1898 and 1907 to 1911. Gold was discovered in quartz veins cutting both Nipissing Diabase and Huronian sedimentary rocks. "The name 'Crystal' was applied to the mine because of the handsome gold specimens obtained from it, some of them showing plane surfaces" (p.139 *in* Coleman 1898).

The property, presently being developed for cottage lots, was mapped on a 1:500 scale over a 350 by 450 m grid.

The northern and eastern sides of the property form part of the Wanapitei Lake Nipissing Diabase intrusion which contains a granophyric phase in the mine area, as sills, dikes and along part of the contact with Gowganda Formation wackes and argillites. The area is characterized by an irregular distribution of Sudbury Breccia. Albite alteration cuts the formations at 290° but ends abruptly, east and west, in contact with gabbro. Sedimentary rocks, completely replaced by albite and ankerite, are enveloped by a broad halo of less–altered rocks. The complete alteration zone is about 150 m wide. Becoming progressively less albitized, the alteration grades to ankerite rhombs within sedimentary rocks, granophyre, and Sudbury Breccia.

Gold is associated with narrow veins of white quartz containing minor ankerite and having a maximum width of 25 cm. The veins trend either at 110° to 130° and dip 70°S, or they trend 170° and dip 60° west. They are restricted to the zone of albite alteration. Visible gold was observed most often near the vein contacts and at the quartz–carbonate interface. Minor pyrite, chalcopyrite, hematite, and galena were also observed.

Gold-bearing quartz–carbonate veins, up to 15 cm wide, are located within the gabbro and appear to follow the regional jointing. They have narrow alteration halos with a maximum width of 70 cm. These are very fine grained, grey, siliceous looking, carbonate rich, and weather to a characteristic bronze colour.

Strong linear depressions and shearing at 020° cut the eastern side of the property. Sudbury–type brecciation in sedimentary rocks containing ankerite rhombs is located in the bottoms of the narrow depressions, while massive gabbro occurs along the sides.

It is possible that the gabbro acted as a barrier to sodium–rich fluids which preferentially replaced the sedimentary rocks near the contact.

The Comstock Mine is located on a peninsula, 250 m southwest of the Crystal workings. An inclined shaft, numerous pits, and trenches are located within a 100 by 100 m area of albite–ankerite–altered sedimentary rocks cut by narrow quartz veins containing free gold, pyrite, and chalcopyrite.

Breccia in Scadding Township

Located at the northeastern corner of Scadding Township, this property was originally surveyed in 1892 as the Eagles Nest Mine when a series of 17, narrow, flat–lying quartz veins was found to carry coarse–grained gold.

The breccia contains an 85 m by 45 m clast of Espanola Formation limestone, floating in typical Sudbury Breccia containing gabbro, wacke, and siltstone clasts. Located on Shaw Point, the area was mapped at a scale of 1:250 over a 150 m by 175 m grid.

The gold–bearing quartz–carbonate veins are less than 10 cm thick, trend 020° to 030°, and dip 08° to 32° northwestward; they are located south and west of the limestone clast. Coarse–grained gold was observed in veins within 25 m of the limestone clast. It is associated with carbonate in the veins and occurs along the footwall contacts.

Soda alteration has been observed on the property along a north– to northeast–trending linear feature located within gabbro and Sudbury–brecciated sedimentary rocks. Gabbro, accompanied by Sudbury Breccia near its contacts, is a common feature throughout the Kukagami Lake area.

A more detailed discussion of the implications of the limestone clast was given in Meyer *et al.* (1988).

SUDBURY BUILDING STONE STUDY

by J.K. Lacey and R.W. Campbell

Interest in building stone in the Sudbury Resident Geologist's District increased dramatically this year. In May of 1988, a one–year program was initiated under COMDA to continue, and expand on, an in–house building stone inventory started in 1986. An Open File Report is in preparation and is scheduled for publishing early in 1989. Assistance during the summer months was provided by M. Lamacraft. R. Henri helped in preparing polished samples for display.

The demand for granite and dimension stone products is steadily increasing in Canadian and world markets. The construction industry uses granite panels for interior and exterior wall veneer and flooring tiles, and represents the greatest market increase. Newly developed fabricating equipment and quarrying techniques have made granite a natural, cost–competitive product to the standard building materials of steel and concrete. The open file report will be designed to outline high–potential areas and to stimulate exploration for viable deposits to compete in this active industry.

Two major European granite companies visited Sudbury this year and were impressed with the number and quality of the prospects they were shown. Most of these prospects must still undergo tests according to the standards of the American Society for Testing of Materials (ASTM) to determine their viability.

Norgranite Company Ltd., a local company, began a large building stone program this summer. The company purchased and staked several prospects, a few of which were previously outlined by this office. At year–end, they were removing small test samples from four sites to be sent to be tested according to the standards of the ASTM; and to be cut, polished, and flamed for market testing.

Northern Industrial Quarries Limited continued to be active in the Sudbury Resident Geologist's District this year. They continued crushing at their existing sites and explored for new colours.

J. Owen had a fracture study conducted on a property in Nairn Township. The property is underlain by Nipissing Diabase, which is moderately to well fractured. J. Owen plans to extract small blocks for use by the tile and curb industry, and for use as crushed material.

Sudbury Canadian Granite attempted to quarry a gabbro which straddles Cadeau and Tennyson townships. The gabbro is about 400 m wide and strikes about 110°. It is fine grained and takes an exceptional polish, but fracturing is too intense for the extraction of commercial–sized blocks. The intrusion has a strike length of about 5 km. An examination of the exposed areas along strike did not reveal any areas suitable for quarrying large blocks.

Positano Granite of Elmvale, Ontario, purchased a quarry prospect in Henry Township. Stone from this prospect was previously known as "Nipissing Granite" and as "Dalmatian Stone", and is now being marketed as Positano Granite for tiles, wall facings, countertops, furniture, etc.. The deposit is a black and white, gneissic anorthosite. Several blocks have been extracted and the stone is presently being marketed.

Carpino Marble's Paddy Lake Prospect, in Secord Township, is being worked to produce fireplace bricks, both polished and rough. The deposit being quarried is a hornblende gneiss with fracturing too intense and irregular for the extraction of full-sized dimension stone blocks. The gneiss has quartz–feldspar veins cutting it. When cut and polished as a fireplace brick, then highlighted with a marble mantel, it creates an impressive-looking fireplace.

Canadian Unique Granite Company opened up a quarry face in Goschen Township this fall; several blocks were taken out. The granite is being marketed under the name of "Killarney Tweed".

The Dana Black Granite Quarry in River Valley was leased to Canadian Shield Quarries Ltd., from Quebec, for three months with an option to purchase. Canadian Shield Quarries Ltd. reopened an old face in early November. Their plans were to extract what they could before winter, then evaluate the stone during the winter.

Khouri Granite Ltd. planned to be in operation before the end of 1988. They will operate a granite-manufacturing plant. When all the equipment has arrived, they will be producing countertops, stairs, curbs, window sills, etc. Khouri Granite Ltd. was awarded $100 000 assistance under the Employment Incentives Program of the Northern Ontario Regional Economic Development Program (NORDEV).

The 1988 field investigations made by this office have produced promising results; several areas of granitoid rocks with limited fracturing have been outlined. Assessment of these prospects is based on a combination of natural characteristics which are critical for development of a quarry.

1. Fracture, sheeting, and joint density are the main criteria for a deposit, as they will determine the maximum size of blocks to be extracted. The orientation and spacing of structural features must allow for removal of large, regular-shaped blocks in the range of 1.5 m by 1.5 m by 2.5 m.
2. Consistency in colour and texture is necessary to maintain equal quality in all blocks. Variegated and contorted gneissic rocks possess greater problems in quarrying due to rapid colour and texture changes; nonetheless, they are in high demand by European companies.
3. The presence of sulphides will effectively limit the stone to internal use. Sulphides and some ferromagnesian minerals weather rapidly, polish dull, and may stain the finished surface. Garnet and biotite pose problems during polishing due to their greatly different hardnesses and their tendency to pluck out of the surface.
4. The location and size of the deposit is also an important factor in the evaluation. If the deposit is located too far from a major road, the cost of road building and maintenance may be too high to establish a quarry.

Approximately 25 sites have been documented by reconnaissance mapping in the Sudbury Resident Geologist's District. These sites show a wide variety in colour and texture and are well suited for dimension stone. Polished slabs 17 by 12 by 2.5 cm have been made of selected sites and are on display in the Sudbury Resident Geologist's office. Five sites are described in some detail.

Rutter Pluton

The Rutter pluton underlies central Bigwood Township and southwestern Delamere Township, parallel to Highway 69. The narrow, elongate body is a well developed, gneissic, red and black monzonite. A well exposed area 150 m by 70 m in Lot 9, Concession I, Delamere Township has near-vertical joints spaced 2 to 3 m apart, with observable horizontal sheeting 1.4 m thick. The gneissic fabric strikes at 150° and dips northeastward at 43°. The size of this deposit is uncertain; overburden gradually increases away from the outcrop and limits its exposure. Areas examined within 500 m of the deposit, to the south and west, show increased jointing, at spacing of only 1 to 2 m, and variation in colour and texture.

St. Charles Sill

The St. Charles Anorthosite is located in northern Casimir Township. The intrusion is intensely deformed with a gneissic fabric around the fringes. The central core is a massive, coarse-grained plagioclase porphyry. This massive section forms a local, prominent, well exposed ridge measuring 150 by 90 m. Jointing is vertical, with a spacing of 2 to 3 m, horizontal sheeting is greater than 2 m. The anorthosite has a greyish steel-blue colour, with plagioclase megacrysts, up to 3.5 cm in size, in a medium- to fine-grained groundmass of plagioclase, hornblende, biotite, and minor garnet.

West Bay Batholith

The West Bay batholith is a highly variable, migmatitic to gneissic monzonite. This large intrusion is centred on West Bay of Lake Nipissing, and underlies most of Loudon and Macpherson townships. This body is made up of two main textural phases: a fine-grained, pink to purple, gently swirling migmatite; and a highly contorted gneiss with numerous red to light brown, pegmatitic sections. Fracturing is moderate to intense locally, but large areas of moderate to low fracturing are common.

Cosby Batholith

The Cosby batholith is located approximately 35 km southeast of Sudbury, and is centred in Cosby Township. Access is via Highway 64, through the villages of Ouellette and Noelville.

The intrusion generally has low relief, with outcrop ranging from 30 to 40 percent of its area; overburden is thin. Primary composition is monzonite to granodiorite.

Generally, rocks within the interior are coarse grained to porphyritic with a massive to foliated texture. Jointing is irregular and variable, with an average spacing of 1 m around the fringe of the batholith.

Three promising areas have been identified and are located near the centre of the body.

1. One site is located 3 km north and 0.75 km east of the village of Ouellette. This site is well exposed due to logging activities. The rock is a highly contorted gneiss, which is medium brown to salmon in colour. Fracture spacing is from 2 to 4 m, with localized, short, discontinuous fracture zones of 1.0 to 1.5 m wide spacing.

2. A large, exposed area occurring 0.5 km northeast of Pure Lake is a massive to slightly foliated, coarse-grained monzonite. Colour is medium brown to salmon, with a slight greenish tinge in places. Fracture spacing is from 2.1 to 3.5 m, well defined, and continuous over large areas.

3. A site located on the western side of a gravel road, 1 km south of the village of Ouellette, is well exposed for 175 m. The area is massive, with limited fracturing spaced 15 m apart. A narrow shear zone cuts across the centre of the outcrop. This medium-brown, coarse-grained monzonite has a porphyritic texture, with feldspar crystals of up to 2.5 cm in size.

Grenville Front Plutons

The Grenville Front intrusions consist of four main bodies: the Killarney Granite, Chief Lake batholith, Bell Lake Granite, and Eden Lake Granite. This large batholithic complex extends northeastward, along the Grenville Front Tectonic Zone, for approximately 100 km, from Killarney to a point southeast of Sudbury. Several sites have been examined in the southern portion of the complex within the Bell Lake Granite. This massive to foliated granite consists mainly of medium-grained quartz monzonite, with many coarse-grained porphyritic phases. The porphyritic phases consist of pink feldspar phenocrysts, approximately 1 by 2 cm in size, in a black matrix. Fracturing is variable, with spacings of from 1 to 2 m. Locally, areas of greater than 2 m spacing have been observed. The central portions of the granites have not been examined due to inaccessibility. Future studies will evaluate these areas of high potential.

GEOLOGICAL DATA INVENTORY FOLIOS

by L.B. Jerome

The GDIF program was funded under COMDA as Project A.4.6.

Eleven GDIFs, which had been prepared in 1987, were published in 1988.

In 1988, 24 GDIFs were completed, all of which still have to be published. Two GDIFs were in preparation at year-end.

Of the GDIFs prepared in 1988, L.B.Jerome completed 20 and J.K. Lacey completed 4.

MANITOULIN "SINKHOLES"

by W. Meyer

Six holes appeared mysteriously, early in 1988, in sands under shallow water near the northern shoreline of Silver Lake, Robinson Township, Manitoulin Island. The holes are from 1.5 to 5 m across, and from 0.5 to 1.0 m deep. Each hole has a sediment mound immediately north of it. Sediments in the holes were soft, and released large amounts of gas when disturbed.

The origin of the holes is not known. The sediment mounds suggest that they are not true sinkholes. The holes occur in an area 100 by 100 m. Three holes line up with the outflow of the lake, forming a linear which trends 037°, suggesting that these four points are controlled by a linear structure in the bedrock. The other three holes appear to be randomly distributed.

Similar such holes have appeared on Moonlight Beach at the eastern end of Ramsey Lake, Sudbury. Their formation is thought to be related to artesian waters which expell sediments from an aquifer at lake bottom when the confining pressure is reduced because of abnormally low lake levels. A similar mechanism may explain the Silver Lake holes.

Regardless of their origin, the holes were deemed to be hazardous to swimmers, particularly small children. On the advice of this office, and in co-operation with the Robinson Township Local Services Board, the Ministry of Natural Resources erected warning signs.

LIMONITE-CEMENTED GRAVELS

by W. Meyer

Two gold occurrences—one on the Sheppard Property in Maclennan Township, the other on CAN-MAC Exploration Limited's claim S605100 in Davis Township—have limonite-cemented glaciofluvial gravels overlying the gold-bearing zones. On the Sheppard Property, the layer is about 50 cm thick at the base of the gravels, and extends to an unknown depth and distance away from the vein along the bedrock slope. At CAN-MAC Exploration

Limited's property, the limonite–cemented gravels are confined to the immediate area of a quartz vein.

Field relationships suggest that the limonite is derived from the oxidation of pyrite with which the gold is associated. Groundwater probably dispersed the iron into overlying gravels. This raised the question: Could limonite–cemented gravels, in general, be used as guides to hidden bedrock occurrences of sulphides? This would make the many gravel pits targets for examination.

Several pits are described in Aggregate Resources Inventory Paper 140 (Ontario Geological Survey 1987) which contain limonite–cemented gravels. The pits occur in Fairbank, Trill, Drury, and Hyman townships, a relatively small area at the southwestern end of the Sudbury Igneous Complex. The question arose: Could these reflect overburden–covered sulphides occurring in bedrock? However, a close examination of the pits revealed a story different from the one described for the Sheppard and CAN–MAC Exploration Limited properties.

Gravels in Fairbank, Trill, Drury, and Hyman townships are not cemented in a single layer immediately above bedrock, but occur, instead, in irregular patches throughout the gravels. Grey, unaltered gravels surround the limonite–cemented patches. A close check of many of these showed that the iron is most probably derived from the gravels themselves, not from the bedrock. More than 90 percent of the limonite–cemented patches have one thing in common: they contain pebbles or boulders of pyrite–rich slate from the Onwatin Formation of the Whitewater Group. Field relationships suggest that the iron in the limonite is derived from the oxidation of pyrite in Onwatin slate pebbles and boulders, and not from the bedrock.

Care must thus be taken in interpreting the source of iron in limonite–cemented gravels; it may be from bedrock sulphides some distance away, or it may be derived from sulphides in the gravels themselves.

SUDBURY BRECCIA STUDY

by R.W. Campbell

A Sudbury Breccia Study was begun this year as part of a MSc thesis through Laurentian University. The study will compare the geochemistry of the host, matrix, and fragments at three different sites. As well as comparing the geochemistry at each site, looking for additions and (or) depletions, the study will look for characteristic additions and (or) depletions between the three sites. Each site was chosen for its single host and fragment lithology, in order to limit the geochemical complexity, to two dimensions.

Site 1 is on the southern shore of Robinson Lake, in McKim Township, where the host and fragments are quartzites of the Mississagi Formation. Site 2 is just north of Kelly Lake, in McKim Township, where the host and fragments are Nipissing Diabase. Site 3 is just north of Cascade Falls, on the eastern shore of the Vermilion River, in Graham Township. Here the host is the Creighton Granite (quartz monzonite) which, at site 3, contains a mafic inclusion. Fragments are from the quartz monzonite and the mafic inclusion.

Field work, in 1988, consisted of mapping the three sites at a scale of 1:200 for an overview of the breccia zones, and at a scale of 1:20 over the sample sites. Samples were collected using a JKS 10 core drill. Over the winter, the samples will be cut for thin section and sent for major oxide and some trace element analyses.

RECOMMENDATIONS FOR EXPLORATION

During the past three or four years, it has become evident that many mineral occurrences outside the Sudbury Structure are associated with a widespread and relatively easily recognized, fine-grained, pink, metasomatic albite alteration. The alteration is prominent in Huronian rocks southwest and northeast of the Sudbury Igneous Complex, but may extend from as far west as Bruce Mines, to as far east as Cobalt. Elsewhere in this report, B.I. Gates describes several mineral occurrences associated with albite alteration.

The alteration may be incipient to almost complete replacement. Analyses running 10 to 11 percent Na_2O are common—11.84 percent Na_20 being the theoretical upper limit for pure albite.

The alteration may be massive, or it may be associated with intense brecciation. In some cases, a breccia has been metasomatized; in others, a metasomatic rock has been brecciated.

Associated with the alteration may be quartz, ankerite, chlorite, amphiboles, and sulphides. The sulphides are commonly pyrite, pyrrhotite, chalcopyrite, and arsenopyrite. Metals detected in anomalous amounts include gold, copper, nickel (up to 2160 ppb), and cobalt (up to 2200 ppb). The metal associations are unusual: some suggest affinity with the Sudbury ores, while others suggest an affinity with Cobalt ores.

Nowhere has it been possible to relate the alteration to any igneous intrusions. The alteration affects Sudbury Breccias, and is cut by olivine diabase dikes. This puts tenuous age limits of 1250 to 1850 Ma on the event.

One intriguing and unanswered question remains: Do these alteration zones form part of a larger, vertical hydrothermal zonation, part of which has been eroded and part of which lies untested at depth?

All pink albite zones, in the Sudbury Resident Geologist's District, are worth a closer look. Having found such a zone, any gold present in it will behave in its usual capricious way; it will be erratically distributed. Perseverance will be needed to find it.

Orofino Resources Limited has successfully mined two small deposits: the Scadding Mine in Scadding Township, and the Norstar Mine in Davis Township. At these deposits, gold is associated, in economic amounts, with albite alteration. The company has an efficient 200 ton per day mill, in Scadding Township, which will need feed by mid-1990. Altered rock abounds in the area, and this may contain other small gold deposits.

CANADIAN CONTINENTAL DRILLING PROGRAM

On October 6 and 7, the local committee of the Canadian Continental Drilling Program, under the chairmanship of D.H. Rousell of Laurentian University, organized a workshop to discuss the feasibility of drilling a 10 km deep hole into the Sudbury Structure. The purpose would be to solve local economic and scientific problems, relating to the origin of the structure and the copper-nickel ores, and to obtain general information on the deep crust which would be of general application in deep crustal studies undertaken elsewhere. The USSR has a drillhole which has reached the 13 km mark on the Kola Peninsula, and West Germany started a 14 km deep drillhole in September, 1987.

About 60 persons attended the workshop, representing organizations as diverse as Inco Limited; Falconbridge Limited; the Ministry of Northern Development and Mines; Energy, Mines and Resources Canada; the National Aeronautics and Space Administration of the United States; universities from Canada and the United States; and the Canadian diamond-drilling industry. The Ministry of Northern Development and Mines supported the workshop financially.

The workshop turned into a mini-symposium on Sudbury geology. A site for a deep hole was not selected. Before that can be done, more geophysical surveys will be needed. It is hoped that Lithoprobe transects will cross the Sudbury Structure.

It was gratifying to see that representatives from the diamond drilling industry were not put off by the technical problems of drilling a fully cored 10 km deep hole. Perhaps one day this will be a reality.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

M.E. Avermann and V. Mueller-Mohr, graduate students, University of Muenster, Federal Republic of Germany, continued summer work on breccias in the footwall of the Sudbury Igneous Complex and the overlying Onaping Formation. The program is of a co-operative nature between the university and the Ontario Geological Survey.

RESEARCH BY OTHER AGENCIES

Three projects, funded under the Ontario Geoscience Research Grant Program, fall within the area of the Sudbury Resident Geologist:

1. W.M. Schwerdtner and W. Shanks, of the University of Toronto, continued a structural analysis of the South Range of the Sudbury Structure. This was the last year of a three-year study.
2. A.J. Naldrett and C. Li, of the University of Toronto, worked on the distribution of platinum group elements in ores of the footwall below the Sudbury Igneous Complex.
3. M. Coniglio and M. Byerley, of the University of Waterloo, worked on the stratigraphy and sedimentology of the Upper Ordovician Georgian Bay Formation on Manitoulin Island.

A. Davidson, of the Geological Survey of Canada, and K. Bethune of the Department of Geology, Queen's University continued work in the Grenville Province near Killarney.

ONTARIO MINERAL EXPLORATION PROGRAM

At the end of November, 1988, 29 agreements were in force in the Sudbury Resident Geologist's District, with companies and individuals, for part or all of 1988, under the Ontario Mineral Exploration Agreement (OMEP).

Planned expenditures under the agreements amounted to $1 837 608. These qualified for $459 275 of OMEP assistance.

In July, the provincial government announced that henceforth, grants for new OMEP applications would be limited to activities carried out before January 1, 1989—the day on which the new Canada Exploration Incentive Program (CEIP) came into effect.

SELECTED PUBLICATIONS RECEIVED

The Resident Geologist's Office usually has the most recent issues of the following periodicals available: The Northern Miner, Northern Miner Magazine, CIMM Bulletin, Economic Geology, Geotimes, GEOS, Mining Journal, Mining Magazine, Mining Engineering, and Canadian Mining Journal.

Below are listed books received by the office in 1988. The books bear thematically upon the district directly and indirectly, and on mining and exploration in general. Books and periodicals are available to the interested reader for viewing at the office.

Bache, J.J.,
1987: World Gold Deposits, A Quantitative Classification; Elsevier Science Publishing Co. Inc., New York, 178p.

Buchanan, D.L.,
1988: Platinum-group Element Exploration; Developments in Economic Geology 26, Elsevier Science Publishing Co. Inc., New York, 185p.

Edwards, R., and Atkinson, K.,

1986: Ore Deposits Geology, and its Influence on Mineral Exploration; Chapman and Hall Limited, London, 466p.

Friedrich, G.H., Genkin, A.D., Naldrett, A.J., Ridge, J.D., Sillitoe, R.H., Vokes, F.M. (editors)

1986: Geology and Metallogeny of Copper Deposits; Springer-Verlag, Berlin, 592p.

Gammon, J.B.,

1988: GOLD and Other Metals: How They are Found and Mined; The Institute of Mining and Metallurgy, London, 83p.

Goode, A.D.T., Bosma, L.I.,

1988: Bicentennial Gold 88, Extended Abstracts Oral Programme; Geological Society of Australia Abstract Series 22, 366p.

Goode, A.D.T., Smyth, E.L., Birch, W.D., Bosma, L.I.,

1988: Bicentennial Gold 88, Extended Abstracts Poster Programme, Volumes 1 and 2; Geological Society of Australia Abstracts Series 23, 666p.

Halls, H.C., Fahrig, W.F. (editors)

1987: Mafic Dyke Swarms; Geological Association of Canada, Special Paper 34, 503p.

Ho, S.E., Groves, D.I. (editors)

1987: Recent Advances in Understanding Precambrian Gold Deposits; Geology Department and University Extensions, The University of Western Australia, Publication No.11, 368p.

Hulbert, L.J., Duke, J.M., Eckstrand, O.R., Lydon, J.W., Scoates, R.F.J.,

1988: Geological Environments of the Platinum Group Elements; Geological Survey of Canada, Open File 1440, 148p.

Karrow, P.F., Calkin, P.E. (editors)

1985: Quaternary Evolution of the Great Lakes; Geological Association of Canada, Special Paper 30, 258p.

Keppie, J.D., Boyle, R.W., Haynes, S.J. (editors)

1986: Turbidite-hosted Gold Deposits; Geological Association of Canada, Special Paper 32, 196p.

Middlemost, E.A.K.,

1985: Magmas and Magmatic Rocks; Longman Group Limited, London 266p.

Milling-Stanley, G.,

1988: GOLD 1988; Consolidated Gold Fields PLC, London, 64p.

Moore, J.M., Davidson, A., Baer, A.J.,

1986: The Grenville Province; Geological Association of Canada, Special Paper 31, 358p.

Nisbet, E.G.,

1987: The Young Earth: An Introduction to Archean Geology; Allen and Unwin Inc., Boston, 407p.

Peters, W.C.,

1987: Exploration and Mining Geology, (Second Edition); John Wiley and Sons, New York, 685p.

Roberts, R.G., Sheahan, P.P.

1988: Ore Deposit Models; Geoscience Canada, Reprint Series 3, 194p.

Robson, G.G.,

1987: Platinum 1987; Johnson Matthey Public Limited Company, London, 63p.

Sabins, F.F.

1987: Remote Sensing, Principles and Interpretation (Second Edition); W.H. Freeman and Company, New york, 449p.

Stowe, C.W.,

1987: Evolution of Chromium Ore Fields; Van Nostrand Reinhold Company, New York, 340p.

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1898 The West Ontario Gold Region; Report of the Bureau of Mines for 1898, Volume 7, Part 2, p.109-145.

Meyer, W., Campbell, R.W., and Gates, B.I.

1988 Sudbury Resident Geologist's Area—1987; p.307-317 *in* Report of Activities 1987, Resident Geologists, edited by C.R. Kustra; Ontario Geological Survey, Miscellaneous Paper 138, 367p.

Meyer, W., Campbell, R.W., Toews, F.H.

1987 Sudbury Resident Geologist's Area, Northeastern Region; p.256-273 *in* Report of Activities 1986, Regional and Resident Geologists, edited by C.R. Kustra; Ontario Geological Survey, Miscellaneous Paper 134, 322p.

Ontario Geological Survey

1987 Aggregate Resources Inventory West of Sudbury, Regional Municipality of Sudbury and District of Sudbury; Ontario Geological Survey, Aggregate Resources Inventory Paper 140, 152p., 7 tables, 6 maps, scale 1:50 000.

16. Southern Region Introduction

A.E. Pitts

Regional Manager, Southern Ontario Region, Toronto.

During 1988, mineral production values in Southern Ontario were approximately $1.5 billion. The region is the main source for Ontario's structural materials such as sand, gravel, crushed stone, clay, shale, calcined lime and building stone; and for its industrial minerals such as salt, gypsum, nepheline syenite, talc, silica and gemstones. Exploration has continued at a high level, with interest in graphite, platinum, gold, quartz, building stone, dolomite and wollastonite being the most sought commodities.

The highlight of the year with regard to exploration activity has been graphite. Although many properties are undergoing active exploration, three deposits have progressed to an advanced stage. Cal Graphite Corporation began development work on its graphite property in Butt Township, and plans to go into production in 1989 with a 5000 tons per day mill handling material from an open pit mine.

North Coast Industries Ltd. has a graphite deposit in Maria Township, 60 miles northwest of Pembroke. The Company has applied for various government permits and is currently doing some infill diamond drilling. Some site work is planned for the winter of 1988–89, with a possible production decision being made in 1989.

Stewart Lake Resources Incorporated put down a decline on its graphite property on Desert Lake in Bedford Township, about 30 miles north of Kingston. Underground exploration was completed this summer with the removal of a 3000–ton bulk sample, 200 tons of which has gone to the Ontario Research Foundation for testing. The Company is currently carrying out a feasibility study, a market study, and environmental work. A production decision might be made in 1989.

The Southern Ontario Region has three Resident Geologists' Offices, located in London, Dorset and Tweed. Resident Geologists provide an advisory service on the geology and mining activity in their districts. They also offer assistance in local resource development and provide advice on land hazards and land–use planning.

The Region also has an office in Bancroft which is managed by Hans Meyn, a Regional Specialist. Hans Meyn is currently studying the stratigraphy and sedimentation of carbonate and associated metasedimentary rocks of the Grenville Supergroup in southeastern Ontario. In 1988, field work was concentrated on the Belmont Lake area in Belmont Township and Peterborough County. The Bancroft office also provides advice on local geology and mining activities.

The Southern Ontario Region has two Drill Core Libraries which are located in Tweed and Bancroft. Each library is staffed by a Drill Core Library Geologist, and relevant drill core reference material is obtained from mineral exploration programs in the area. This drill core is logged and indexed for ready access by clients.

The Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, is funding several geological and mineral development studies in southern Ontario. Projects on building stone, industrial minerals, buried aggregates and refractory minerals are operating out of the Tweed and Dorset offices.

These COMDA projects are providing information about several mineral development opportunities which are described in more detail in the following reports.

17. Algonquin Resident Geologist's District—1988

M.I. Garland[1], D.J. Villard[2], and C. Marmont[3]

[1]Staff Geologist, Ministry of Northern Development and Mines, Dorset.

[2]Resident Geologist, Ministry of Northern Development and Mines, Dorset.

[3]Geologist, COMDA, Ministry of Northern Development and Mines, Dorset.

INTRODUCTION

Exploration in the Algonquin District continued in 1988 at a moderate pace. Claims recorded were up from those recorded in 1987. During 1988, exploration work in graphite continued on three properties. Cal Graphite Corporation began development work on its deposit in Butt Township, with production scheduled to begin in mid–1989. North Coast Industries Ltd. has completed the feasibility study on their graphite deposit in Maria Township and is expected to make a decision on production early in 1989. Astwood Park Resources Inc. has completed the first stage of a multi–phased exploration program on a graphite deposit in Laurier Township.

The four–year program, funded under the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic Regional Development Agreement signed by the governments of Canada and Ontario (ERDA), is in its third year. Work concentrated on investigations of high–aluminum calcic feldspar in anorthositic intrusive rocks, and on evaluations of banded gneiss suitable for production of thin veneer panels and tiles.

Exploration for platinum group metals, precious metals, and industrial minerals was the main activity by mining companies and prospectors in 1988.

Public education was again an important function of the office, as the Ministry of Northern Development and Mines funded a significant part of the minerals program at the Leslie M. Frost Natural Resources Centre. Specialized minerals programs were also given to school groups, clubs, and provincial parks.

MINING ACTIVITY

The only producing mines in the district at present are several flagstone and quartz quarries. The most notable flagstone producer is the Mill Lake Quarry at Parry Sound, which is producing steadily. Three quarries in Rama Township produce granite and limestone dimension stone, and flagstone on a steady basis. Other smaller flagstone quarries produce stone on demand. The old International Quartz Quarry in McClintock Township is worked on an intermittent basis, the crushed quartz product being sold for various decorative uses. The Bluestar Amazonite Mine in Chapman Township produces a small amount of amazonite, smokey quartz, and garnet, catering to the tourist industry.

ADVANCED EXPLORATION AND DEVELOPMENT

CAL GRAPHITE CORPORATION

During 1988, the company began development on its graphite property in Butt Township. The following work was carried out during the year:

1. A detour road, partially funded by the Ministry of Northern Development and Mines, was constructed around the property because the existing access road to Algonquin Park traversed the deposit.
2. Internal mine roads were constructed to service the waste rock area, the tailings pond, and the polishing pond.
3. Stripping was carried out in the area of the mine, the tailings pond, and the polishing pond.
4. Construction was started on the mill complex.

A Certificate of Approval from the Ministry of the Environment has been issued and the way is clear for production, expected in 1989.

During the winter (1988–89), installation of equipment will take place in the mill complex. Plans call for a 5000 ton per day facility to handle the material from the open pit.

Construction was started on a 71–acre site in Walden, near Sudbury. This facility will house the company's head office, as well as a combined research centre and pilot plant where the process of upgrading the graphitic carbon content of the flake to 98 to 99.9+ percent can be researched.

The end of the year saw the completion of a $1 100 000 exploration program on the property. Initial indications are that the reserve estimates will be about double the previous tonnage estimate of 29 500 000 tons of proven and probable reserves.

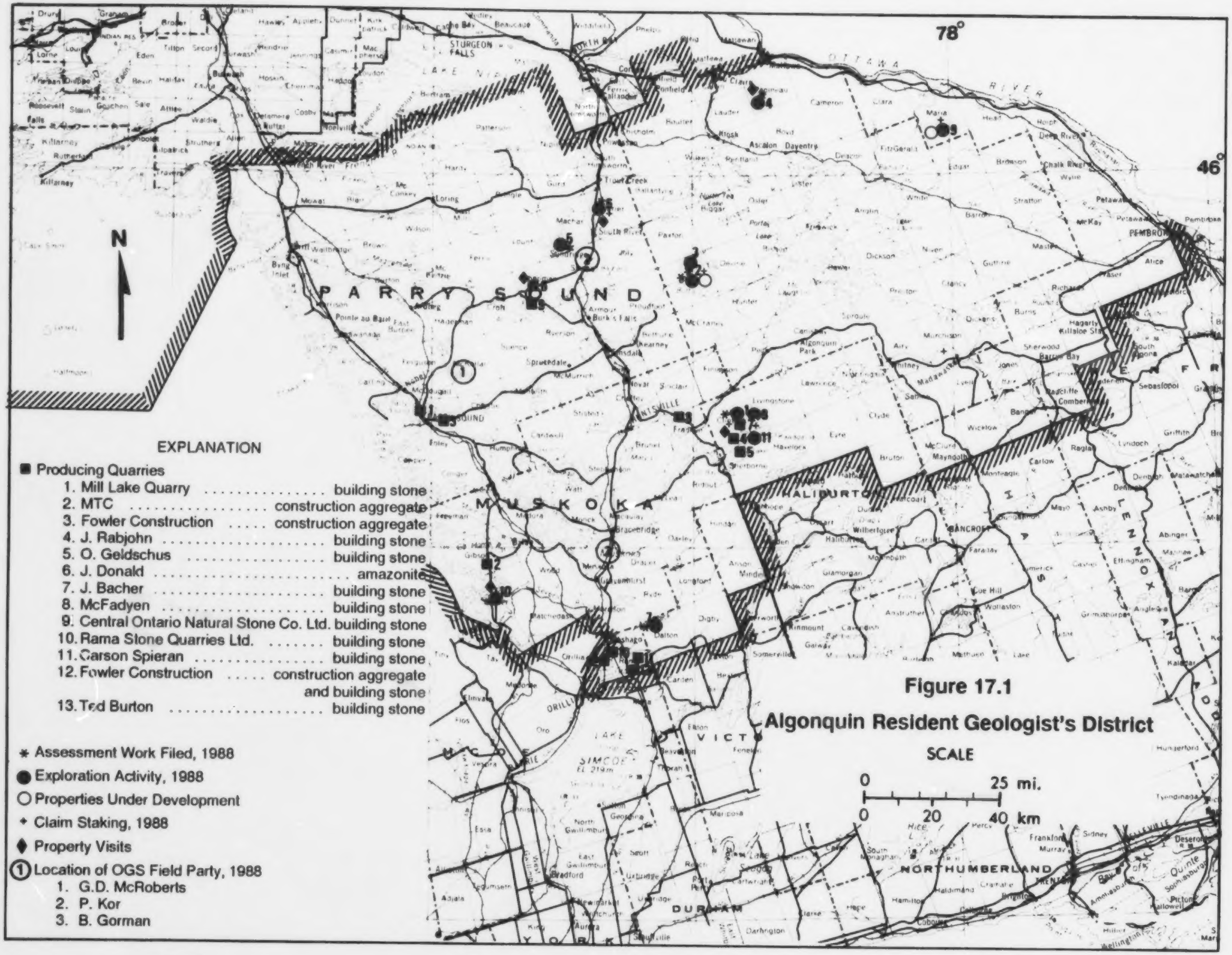
78°
46°
OTTAWA RIVER
N
PARRY SOUND
MUSKOKA
HALIBURTON
LENNOX AND ADDINGTON
NORTHUMBERLAND
DURHAM
VICTORIA
LAKE SIMCOE
STURGEON FALLS
PEMBROKE
BANCROFT
EXPLANATION
■ Producing Quarries
1. Mill Lake Quarry .... building stone
2. MTC .... construction aggregate
3. Fowler Construction ..... construction aggregate
4. J. Rabjohn .... building stone
5. O. Geldschus .... building stone
6. J. Donald .... amazonite
7. J. Bacher .... building stone
8. McFadyen .... building stone
9. Central Ontario Natural Stone Co. Ltd. building stone
10. Rama Stone Quarries Ltd. .... building stone
11. Carson Spieran .... building stone
12. Fowler Construction ..... construction aggregate and building stone
13. Ted Burton .... building stone
* Assessment Work Filed, 1988
● Exploration Activity, 1988
○ Properties Under Development
+ Claim Staking, 1988
♦ Property Visits
① Location of OGS Field Party, 1988
1. G.D. McRoberts
2. P. Kor
3. B. Gorman
SCALE
0 25 mi.
0 20 40 km

Figure 17.1
Algonquin Resident Geologist's District

TABLE 17.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	B. Vihonen	Airborne EM, Mag. McClintock Township
2	Cal Graphite Corporation	Diamond drilling, developmental work, Butt Township
3	Swayze Resources	Geology, Butt Township
4	Premier Explorations	Airborne Mag, VLF, EM, Stripping, Geology, Papineau Township
5	McDermott, G	Stripping, Machar Township
6	Astwood Park Resources	Geophysics, Stripping, Trenching, Laurier Township
7	Cloughley, R.	Diamond drilling, Dalton Township
8	Jones, F.	Staking, McClintock Township
9	Northcoast Industries	Developmental work, Maria Township
10	Atkinson, F.	Geology, Sampling, Baxter Township
11	Rabjohn, J.	Developmental work, McClintock Township

TABLE 17.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1988	164	63	563	7,841.7	5,440.0	104.98	13,799.68

NORTH COAST INDUSTRIES LTD.

During 1988, the company continued work on its graphite property in Maria Township, Renfrew County. This property is the former Princeton Resources property that is now being worked as a joint venture between the two companies. Controlling interest is held by North Coast.

At time of writing, the property was at the pre–feasibility–feasibility stage. Infill diamond drilling is planned so as to provide a better overall picture of the deposit. The company has applied to the Ontario government regarding the approvals it will need before production can begin. Some site work is planned for the winter of 1988–89. If a production decision is made early in 1989, a late 1989 or early 1990 start–up date is anticipated.

EXPLORATION ACTIVITY

As of December 10, 1988, a total of 164 claims were recorded in the Algonquin Resident Geologist's District. Exploration activity concentrated on interests in graphite, platinum, gold, quartz, and building stone, as shown in Figure 17.1 and Tables 17.1 and 17.2.

Graphite

There are five graphite occurrences in the district currently undergoing active exploration.

Cal Graphite Corporation is in the developmental stage with its deposit in Butt Township, as mentioned in the previous section. North Coast Industries Ltd. is in the feasibility stage with its deposit in Maria Township, being worked as a joint venture with Princeton Resources, also as discussed in the previous section.

Astwood Park Resources Inc. has completed the first stage of an exploration program on a graphite occurrence in Laurier Township. Geological mapping and extensive trenching and sampling was done, with follow–up diamond drilling planned, pending the results from the sampling.

Swayze Resources continued with a basic geological survey on its claims adjoining the Cal Graphite Property in Butt Township.

A prospector, Fred Atkinson, of Rosseau, has been mapping and sampling a graphite occurrence in Baxter Township.

Platinum

Three mafic intrusions are under investigation for platinum group metals: the Caribou Lake intrusion in McConkey Township, the Memasagamesing intrusion in Hardy Township, and an intrusion in McClintock Township.

Noramco Explorations has been working on the Caribou Lake intrusion, a layered norite, but no work has been filed for assessment for 1988.

Lacana Mining Corporation has staked the Memasagamesing intrusion, another layered norite, in Hardy Township, and has done geophysical surveys in 1987, but no work has been filed for 1988. Both intrusions have been documented and have been examined in the past for nickel (Friedman 1955, 1957).

A group of 140 claims has been staked over a circular norite intrusion in McClintock Township.

The area was flown using an airborne magnetometer and electromagnetometer, and follow-up trenching and sampling was done on the showings. Winter plans call for linecutting, ground geophysics, and diamond drilling.

Gold

Limited exploration for gold bv local prospectors continued in the district.

Vanadium-Magnetite

Premier Explorations Inc. has staked six claims over the Brazeau titaniferous magnetite deposit in Papineau Township. Work this year consisted of airborne magnetometer, VLF and electromagnetic surveys, stripping, sampling, and a geological survey.

Quartz

There has been an interest expressed by local prospectors in the many, small but pure, quartz veins found throughout the district.

Kyanite

A prospector has conducted diamond drilling on a kyanite occurrence in Dalton Township.

Stone

A prospector, Jeff Rabjohn, is in the process of redeveloping a flagstone quarry in McClintock Township.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist for the Algonquin District is located in Dorset, about 30 km southeast of Huntsville. The office is currently staffed by David Villard, Resident Geologist; Mary Garland, Staff Geologist; Chris Marmont, Philip Zuberec, and Dale Conrod, Contract Geologists; and Jeanette Reed, Secretary.

A significant amount of the Resident Geologist's time has been spent working with Cal Graphite Corporation and its consultant engineers, and with the Ministry of Natural Resources and the Ministry of the Environment, co-ordinating the approval process for the graphite mine. The Resident Geologist has been instrumental in organizing the Grenville Working Group and hosting the first seminar, held in Dorset. As in previous years, the bulk of the Resident Geologist's time was spent on consultative duties, with requests for information or assistance coming from companies and individuals engaged in mineral exploration and development in the district.

Mary Garland has finished a detailed study of the geology of the Cal Graphite Deposit, and an open file report is in preparation. Her work on the Cal Graphite Deposit was displayed at the Geological Association of Canada Annual Meeting in St. John's, Newfoundland.

Mary Garland is presently conducting a platinum-precious metals project. It has been revamped to include the economic significance of the gabbroic rocks of the western Parry Sound Domain, in light of the initial results of the 1988 field work.

Mary Garland also presented a display on the geology of Parry Sound at the Ontario North Now Pavilion at Ontario Place during Parry Sound Week, and gave several talks and mineral presentations to the public at three provincial parks, and to various mineral clubs, in the district. Mineral sessions were conducted at schools of both the Muskoka and Haliburton boards of education, and as of the fall of 1988, one and a half days a week is spent at the Leslie M. Frost Natural Resources Centre contributing to the minerals program offered to school groups. Additionally, the Staff Geologist supports the Resident Geologist in fulfilling the mandate of the office.

Chris Marmont, Philip Zuberec, and Dale Conrod continued with the third year of a four-year study, funded under COMDA. This project is attempting to evaluate the industrial mineral potential and rare earth element potential of the Parry Sound-Muskoka-Nipissing-Haliburton areas. Two open file reports were released in 1988 (Marmont 1988a, 1988b), and one is in preparation. There are plans to consolidate the research results into a Mineral Deposits Circular.

Chris Marmont attended an industrial mineral conference in North Carolina, and the Friends of the Grenville field trip in the Killarney area.

PROPERTY EXAMINATIONS

Six mineral properties were examined: two for graphite, one for feldspar, one for flagstone, one for titaniferous magnetite, and one for platinum. Other occurrences examined fall into areas covered by research projects and are included in that section.

BAXTER TOWNSHIP GRAPHITE

Fred Atkinson of Humphrey staked four claims in late 1987, in Baxter Township, Concession XII, Lots 26 and 27, to cover a graphite occurrence. The occurrence consists of graphite flake contained in a mixture of siliceous metasediments and marble tectonites. It appears that the siliceous unit has been boudinaged, and now constitutes fragments within the marble. Graphite flake occurs in both units. The occurrence has a strike length of several kilometres.

LAURIER TOWNSHIP GRAPHITE

Astwood Park Resources Inc. has acquired the option on the three mining leases over a graphite deposit in Laurier Township. In the process of extensive trenching, the company has stripped the zone containing the original gold pits and a vein of graphite. Detailed examination has revealed that the vein of graphite is fracture controlled, and has been subjected to stress which caused internal deformation. A unit containing disseminated graphite flake is also complexly folded on an outcrop scale, indicating the probability of structural complexity on a regional scale. It is becoming apparent that all the graphite-bearing units in the district are complexly deformed.

McCLINTOCK TOWNSHIP FLAGSTONE

A visit was made to a flagstone quarry being developed by Jeff Rabjohn in Concession II, Lot 16, McClintock Township. The quarry has previously produced 3200 tons of flagstone. The major rock types are a dark grey metatonalite and a pink meta-arkose. The rock can be split into two– to four–inch thick slabs and sold as facing stone.

CHAPMAN TOWNSHIP AMAZONITE

The Bluestar Mine in Chapman Township is continuing to offer mineral collecting trips to tourists. A tractor has replaced the horses to draw the wagons to the site, but Eeyore the donkey is still present at the pit.

PAPINEAU TOWNSHIP TITANIFEROUS MAGNETITE OCCURRENCE

Known as the Brazeau–Wood vanadium–bearing titaniferous magnetite deposit, this occurrence has a history of exploration dating to pre–1942 (Assessment Files, Resident Geologist's Office, Dorset). The general geology in the area of the occurrence consists of plugs and lenses of a gneissic gabbroic anorthosite (described as a massive feldspar–hornblende rock) and bands of gneissic tonalite and quartz monzonite (Lumbers 1974, 1976). The magnetite lenses occur at the contact between the gabbroic anorthosite and a gneissic quartz monzonite. Fifteen trenches have been dug along the strike of a 2500 foot long lens of magnetite. The trenches traverse the road, providing excellent access to the property. The magnetite lens occurs in swampy ground, and most of the trenches are now water–filled and overgrown. The samples average approximately 10 percent titanium and 3000 ppm vanadium.

McCLINTOCK TOWNSHIP PLATINUM OCCURRENCE

Bruno Vihonen has acquired 140 claims in central and northern McClintock Township. The claims cover a norite body which locally contains pyrite and pyrrhotite. The property is being evaluated for nickel, cobalt, and platinum. An airborne magnetic–electromagnetic survey was flown early in 1988, and results indicate the presence of conductors not tested by previous exploration programs.

RESEARCH BY RESIDENT OFFICE STAFF

GRAPHITE

by M.I. Garland

The detailed study of the Cal Graphite Deposit was completed as an adjunct to the graphite project (Garland 1987a), and a detailed publication is in preparation. It was found, from petrographic studies and compilations of drill core, that nongraphitic units are in the form of three dimensional lenses and boudinaged horsts essentially floating within the graphitic units. These results affected the tonnage and grade figures for the mine, as the large barren blocks are finite in the third dimension and can be selectively removed from the ore, in effect increasing the grade. The graphitic units have been tightly folded about north– to northeast–trending axes, thickening the original horizon.

As part of continuing interest in graphite in the Central Gneiss Belt, the stripped area at the deposit in Laurier Township was mapped in detail. It was found that this deposit is as intensely folded as the Cal Graphite and Ryerson deposits, and that this folding seems to be present in all of these graphitic units, where there is a concentration of graphite.

PLATINUM AND PRECIOUS METALS

by M.I. Garland

Field work continued on the platinum and precious metals project, concentrating on the copper–zinc–gold showings in the western Parry Sound Domain of the Central Gneiss Belt. Preliminary findings have indicated that many of these showings, particularly the copper–gold showings, are hosted in gabbroic rocks. Also, there appear to be more rocks of gabbroic affinity than were originally believed to be present in the western Parry Sound Domain. The economic significance of these gabbros has been included as part of the platinum–precious metals research.

INDUSTRIAL MINERALS AND BUILDING STONE STUDIES

by C. Marmont

Field work for the third year of a four–year, COMDA–funded program to evaluate the industrial mineral and building stone potential of the Muskoka–Parry Sound–Nipissing area was completed.

The results of the first two years' work were reported by Marmont and Johnston (1987a, 1987b), and by Marmont (1988a, 1988b). Field work during 1988 concentrated on feldspar (anorthosite) and building stone. A minor amount of time was spent examining pegmatites which have some potential for feldspar, silica, and rare earth elements (Marmont *et al.* 1988).

Work on feldspar was directed towards characterizing the chemistry and mineralogy of seven major anorthosite–gabbroic anorthosite bodies (Marmont *et al.* 1988), and to identifying areas of clean anorthosite which might constitute potential feldspar resources. Such feldspar has potential applications in the glass, ceramics, filler, and insulation industries.

Work on building stone focused on orthogneiss units potentially suitable as architectural or dimensional stone which can be sawed into thin veneers for wall cladding and flooring (Marmont *et al.* 1988). Field work included the completion of reconnaissance roadside surveys; follow–up surveys in areas which appeared to have a low density of joints, and uniform colour, texture, and grain size; and extraction of blocks (0.5 m by 0.5 m by 0.5 m) for sawing and polishing tests.

RECOMMENDATIONS FOR EXPLORATION

The work in the western Parry Sound Domain is starting to synthesize a geological overview for that area, and is developing some interesting exploration targets for gold and gold–copper mineralization. Further research will pursue the gabbro–copper–gold association.

The building stone project has highlighted some prospects at Woods Road, Ardbeg, and Milford Bay (Marmont *et al.* 1988). Prospective areas for exploration in building stone are the Powassan Batholith, the Killbear area, and the Huntsville area. Orthogneiss units offer the greatest potential for dimensional stone. There are extensive areas with undeveloped potential flagstone, notably in the Magnetawan and Restoule areas.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Two field parties were active in the area; both were funded under COMDA.

G.D. McRoberts, R.I. Macfie and D.J. Hammar, of the Precambrian Geology Section, carried out a detailed geological mapping project in the area immediately east of Parry Sound, covering NTS sheet 31 E/5 NW. This was the last year of a three–year mapping program in the area, which included NTS sheets 31 E/13 SW and 31 E/12 NW.

Phil Kor, of the Engineering and Terrain Geology Section, completed the final year of a three–year Quaternary mapping project in the Parry Sound area. The area encompassed by map sheets NTS 31 E/11 and 31 E/14 was mapped in detail.

Bob Gorman, of the Aggregate Assessment Office, continued with the aggregate assessment of the Algonquin District, completing the towns of Bracebridge and Gravenhurst. Surficial mapping was followed with seismic surveys and backhoe testing. A significant deposit of coarse outwash gravel was found in McAuley Ward, and as yet is undeveloped.

RESEARCH BY OTHER AGENCIES

GEOLOGICAL SURVEY OF CANADA

Nick Culshaw (Dalhousie University) completed the second year of a three–year geological mapping program, which covers an area between Georgian Bay and Highway 69, and from Key Harbour south to Port Severn, providing a good cross section of much of the Central Gneiss Belt at a scale of 1:50 000. The 1987 mapping completed the northeastern part of the corridor, from Key Harbour to Dillon.

ENERGY, MINES AND RESOURCES CANADA

Energy, Mines and Resources Canada has reported on tests performed on material from the Whitestone Anorthosite, to evaluate the feasibility of extracting alumina from the high–alumina plagioclase feldspar.

NATIONAL MUSEUM OF CANADA

Scott Ercit has been documenting pegmatites in the Huntsville–Parry Sound area.

UNIVERSITIES

Several workers from the University of Michigan at Ann Arbor, including L.M. Anovitz, E.J. Essene and D.P. Moecher, have been conducting research into thermobarometry of the region, and the carbon isotope geology of the Whitestone Anorthosite.

A student from the University of Mainz, FRG, under the partial supervision of W.M. Schwerdtner of the University of Toronto, is studying the metamorphism and deformation of several generations of dikes in the area of the Parry Sound–Moon River domain boundary.

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18. Southeastern Resident Geologist's District—1988

P.W. Kingston[1], S. van Haaften[2], D.A. Williams[3], R.R. Wolf[3], A. MacKinnon[3], S.J. Black[3], P. LeBaron[3], W.F. Caley[4], G.A. Gorrell[3], W.T. Grant[5], H.D. Meyn[6], L.G.D. Thompson[7], and V.C. Papertzian[8]

[1]Resident Geologist, Ministry of Northern Development and Mines, Tweed.

[2]Staff Geologist, Ministry of Northern Development and Mines, Tweed.

[3]Geologist, COMDA, Ministry of Northern Development and Mines, Tweed.

[4]COMDA Contract Researcher, Department of Mining and Metallurgical Engineering, Technical University of Nova Scotia, Halifax, Nova Scotia.

[5]Drill Core Library Geologist, Ministry of Northern Development and Mines, Bancroft.

[6]Regional Specialist, Ministry of Northern Development and Mines, Bancroft.

[7]Regional Geophysicist, Ministry of Northern Development and Mines, Tweed.

[8]Drill Core Library Geologist, Ministry of Northern Development and Mines, Tweed.

INTRODUCTION

During 1988, 29 mines continued to operate in Southeastern District, producing building stone, gemstones, industrial minerals, and magnesium. Saint Mary's Cement Corporation at Bowmanville planned a major plant expansion, and a new dimension stone processing plant may be built at Port Hope.

Exploration continued at a high level. Advanced exploration took place for andesite, dolomite, graphite, wollastonite, and gold.

The Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA), signed by the governments of Canada and Ontario, is funding several geological and mineral development studies in Southeastern District. Projects on building stone, industrial minerals, and refractory minerals are operating out of the Tweed Resident Geologist's Office, and a project on buried aggregates was carried out from the Ministry of Natural Resources (MNR) office at Kemptville. The Resident Geologist worked jointly with the Ontario Geological Survey (OGS) on a study of mineralization along the Precambrian–Paleozoic unconformity, and with Geological Survey of Canada (GSC) on sillimanite and zinc.

The COMDA projects are providing information about several mineral development opportunities, especially for building stone, graphite, nepheline syenite, talc, and wollastonite. A later section of this report contains short summaries of the COMDA projects.

An addition to the Drill Core Library building, north of Tweed, was being built during the autumn of 1988, to house the Resident Geologist and his staff. The Resident Geologist is expected to move into this new facility in January 1989.

The Resident Geologist's Office was staffed in Tweed by P.W. Kingston, Resident Geologist, L.G.D. Thompson, Regional Geophysicist, S. van Haaften, Staff Geologist, V.C. Papertzian, Drill Core Library Geologist, and C.M. Neal, Secretary. W.T. Grant was the Drill Core Library Geologist in the Bancroft Drill Core Library and reported to the Resident Geologist in Tweed. D.A. Williams, A. MacKinnon, P. LeBaron, and S.J. Black were Geologists for the Canada–Ontario Minerals Development Subsidiary Agreement (COMDA). G.A. Gorrell at MNR's Kemptville Office, and R.R. Wolf at OGS in Toronto, were COMDA geologists working under the Tweed Resident Geologist's direction. D. Burley was Mines Clerk (COMDA), and J.C. Rudd worked on contract as Geophysics Assistant. All personnel employed under COMDA are contract staff.

The Resident Geologist employed five summer students at Tweed under Experience '88. One summer student was employed at the Bancroft Core Library.

The Resident Geologist operated two Section 38 Special Employment Programs at Tweed, which were sponsored by the Crowe Valley Conservation Authority. These projects provided a total of 85 weeks of work to four program participants. The participants mainly collected and coded Resident Geologist's information for entry into the office's

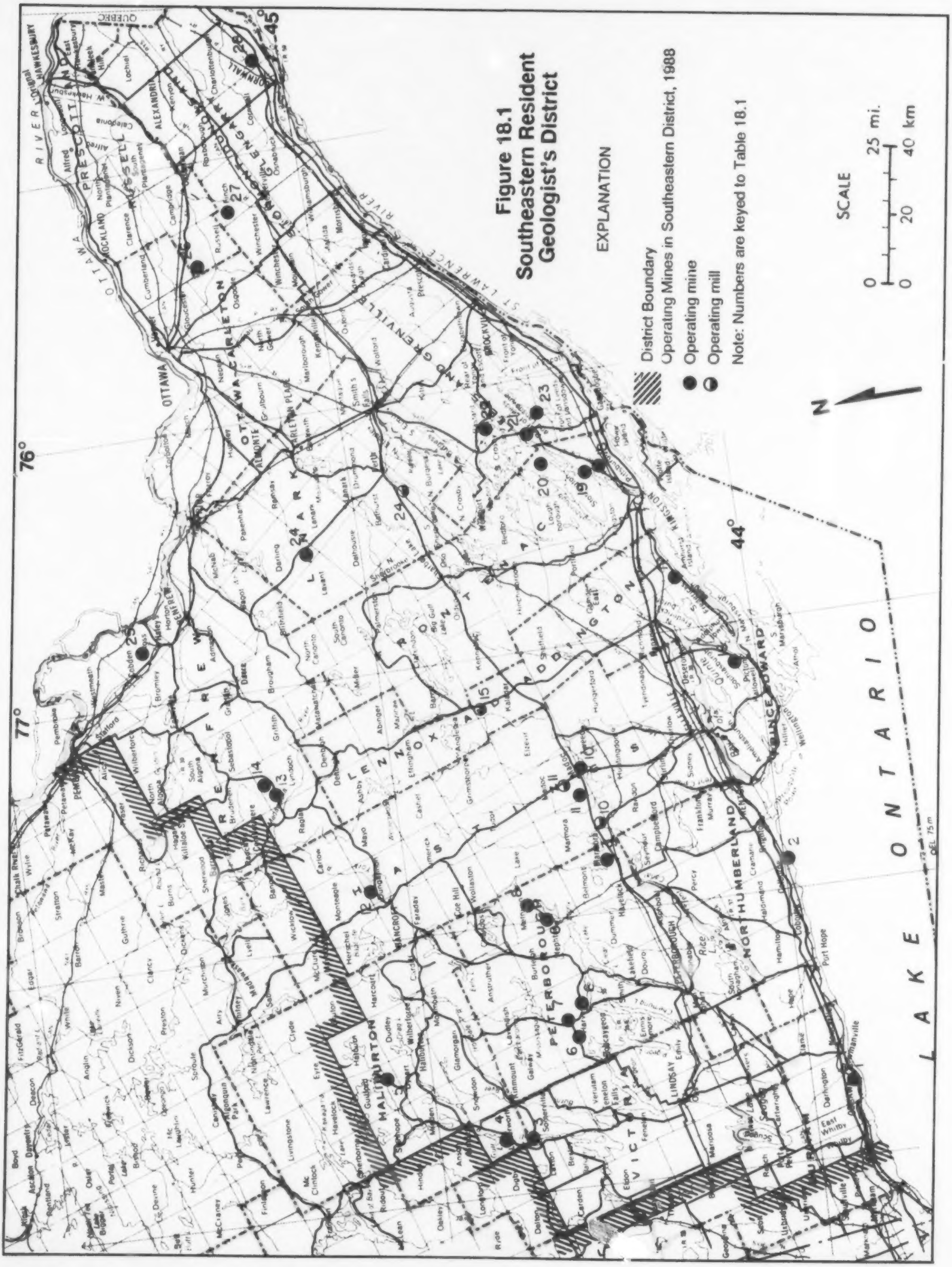


Figure 18.1 Southeastern Resident Geologist's District

EXPLANATION
▨ District Boundary
Operating Mines in Southeastern District, 1988
● Operating mine
◐ Operating mill
Note: Numbers are keyed to Table 18.1
SCALE
0 20 25 mi.
0 20 40 km
N
77°
76°
45°
44°
LAKE ONTARIO
OTTAWA RIVER
ST. LAWRENCE RIVER
OTTAWA
KINGSTON
QUEBEC
PRESCOTT
RUSSELL
CARLETON
STORMONT
GRENVILLE
LANARK
RENFREW
FRONTENAC
LENNOX AND ADDINGTON
HASTINGS
PRINCE EDWARD
NORTHUMBERLAND
PETERBOROUGH
HALIBURTON
VICTORIA
DURHAM

TABLE 18.1. MINING ACTIVITY 1988.

MAP NO	COMPANY	MINE	LOCATION (TOWNSHIP)	COMMODITIES	NOTES
1	St. Mary's Cement Ltd. (Bowmanville)		Darlington	Cement	Cement is produced on site. A major plant expansion is planned.
2	Saint Lawrence Cement Co. Ltd.		Cramahe	Cement	Mine only. Rock is barged to Clarkson plant near Oakville for processing.
3	Central Ontario Natural Stone		Somerville	Stone	Flagstone
4	MacDonald		Lutterworth	Stone	Flagstone
5	Bolenders Ltd.		Guilford	Dolomite	Dolomite (marble): poultry grit, golf sand, decorative aggregate, white powder sold for use in bricks and mortar.
6	Windover, N.		Harvey	Limestone	Flagstone
7	Ormell Sand and Gravel		Harvey	Limestone	Flagstone is produced from this limestone aggregate quarry
8	Indusmin Division of Falconbridge	Blue Mountain, Nephton, Cabin Ridge quarries	Methuen	Nepheline Syenite	Nepheline syenite is produced from two mines in this township. Magnetite is also produced.
9	3 M Canada Inc.		Belmont	Traprock	Roofing granules are produced from traprock at this mine.
10	Canada Talc Ltd.	Henderson & Conley Mines	Huntingdon	Talc, Dolomite	Talc products, and ground and crushed dolomite products including terrazzo chips are produced from this mine. This company operates mills at the mine site and at Marmora.
11	Stoklosar Marble Quarries Ltd.		Madoc	Marble	Marble chips (terrazzo)
12	Princess Sodalite Mine	Princess Sodalite Mine	Dungannon	Gemstones	Sodalite is mined, and sold for mineral specimens.
13	Wal-Gem Lapidary	Wal-Gem West Quarry	Lyndoch	Gemstones, Stone	Rose quartz mineral specimens are mined. Rock chips for decorative aggregate have been mined in the past, and in 1988 some small granite blocks were mined for use as 'field stone' construction material.
14	Wal-Gem Lapidary	Wal-Gem East Quarry	Lyndoch	Gemstones	Mineral specimens, especially beryl. This site is opened to mineral collectors for a daily fee.
15	Easton Minerals Ltd.	Northbrook Mill	Kaladar	Industrial Minerals	This mill (no mine) processes talc and dolomite from Madoc, granite from Rear of Leeds and Lansdowne Township, and silica.
16	Lake Ontario Cement Ltd.		Sophiasburg	Cement	Cement is produced on site
17	Canada Cement LaFarge Ltd. (Bath)		Ernestown	Cement	Cement is produced on site.
18	Hughes, W.		Pittsburgh	Silica	Sandstone is mined for silica, and sold for use in manufacture of portland cement.
19	Sloan, N.	Sloan Quarry	Storrington	Sandstone	Sandstone building blocks (ashlar).
20	Rock of Ages Canada Ltd.	Battersea Granite Quarry	Storrington	Granite	Granite blocks for dimension stone. Blocks are processed at Beebe, Quebec. A new area near the producing quarry was tested in 1988.
21	Easton Minerals Ltd.		Rear of Leeds and Lansdowne	Granite	Decorative red granite aggregate is produced from this quarry.
22	Arriscraft		Bastard	Sandstone	Sandstone for manufacture of reconstituted sandstone. Raw material is shipped to Cambridge, Ontario for processing.
23	Jackson, Rideauview Contractors		Rear of Leeds and Lansdowne	Sandstone	Sandstone building blocks (ashlar).

TABLE 18.1. CONTINUED.

MAP NO	COMPANY	MINE	LOCATION (TOWNSHIP)	COMMODITIES	NOTES
24	Steep Rock Resources Inc.	Tatlock Quarry	Darling	Calcite	High-purity, fine-grind calcite for fillers, plus other grades of calcite, and marble chips. Mill is west of Perth.
25	Chromasco Ltd.(Div. of Timminco)		Ross	Magnesium	Magnesium is produced from dolomite mined at this location. Strontium, Calcium are produced from purchased material.
26	Canada Brick Division, Jannock Ltd.		Russell, Gloucester	Clay Products	Brick, from red shale. Quarry in Russell Tp, Plant in Gloucester Tp.
27	A.L. Blair Construction Ltd.		Finch	Lime	Agricultural Lime is produced from this crushed aggregate quarry.
28	Cornwall Sand and Gravel		Cornwall	Limestone	Limestone blocks for dimension stone are produced from thick upper beds of this crushed stone quarry

computers, but they also helped geologists and the geophysicist in field work.

MINING ACTIVITY

During 1988, 29 mines were producing building stone, gemstones, and industrial minerals in Southeastern District (*see* Figure 18.1 and Table 18.1). Chromasco Limited continued to produce calcium, magnesium, and strontium metals at Haley Station in Ross Township. Many pits and quarries produced mineral aggregate.

Saint Mary's Cement Corporation planned a major expansion for the plant at Bowmanville in Darlington Township. The Financial Post (October 31, 1988) reported that this planned $160-million expansion will increase capacity to 5000 t per day from 2000.

Great Lakes Granite plans to build a dimension stone finishing plant at Port Hope, in Hope Township. The plant will use a combination of Ontario stone and imported material.

ADVANCED EXPLORATION AND DEVELOPMENT

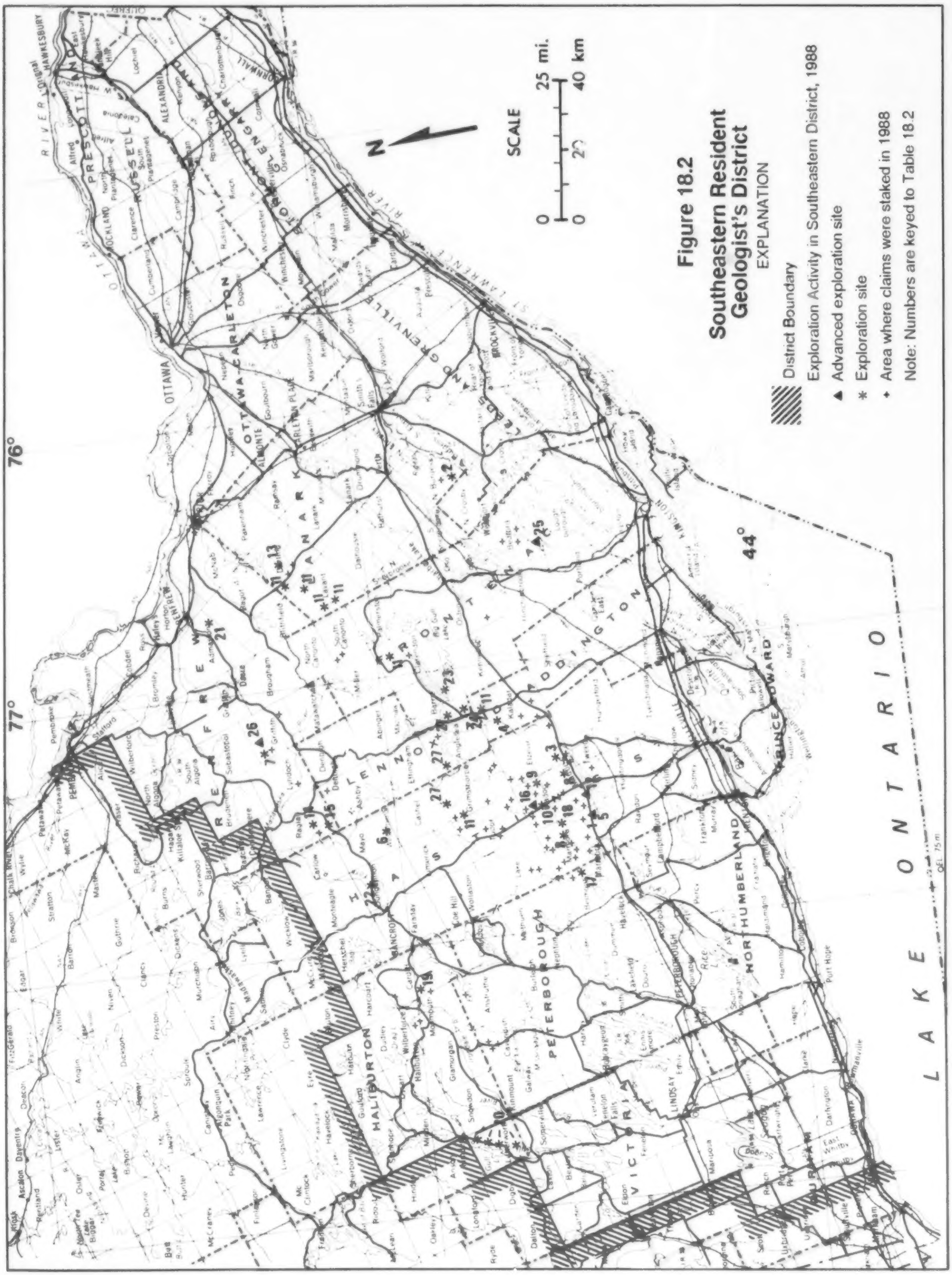
Exploration activity is shown in Figure 18.2 and Table 18.2. The wollastonite deposit at Deloro in Marmora Township was undergoing advanced exploration during 1988. Industrial Minerals (October 1988) reported that:

> "Joint venture Partners in the Deloro wollastonite project Cominco Limited (51%) and Platinova Resources Limited (49%) have successfully concluded pilot plant grinding tests on the ore. These have confirmed that a high grade product can be supplied to the marketplace. An environmental impact study for the project has been instigated and a production decision is expected towards the end of the year.
>
> ... A 10,000 foot drilling programme has been concluded which has identified a resource with open-pit reserves of 450,000 short tons grading 47% wollastonite in one zone and in a separate zone 680,000 tons of inferred ore grading 39% have been revealed. If an affirmative decision is made to proceed with exploitation a preliminary extraction rate of 55,000 tpa is envisaged, giving the mine a life in excess of 20 years."

The Micham Exploration Incorporated–Mono Gold Mines Incorporated joint venture put down an exploration decline on its gold property near Bannockburn, in Madoc Township. The Northern Miner (August 1, 1988) reported that:

> "Initial results from the Bannockburn gold project near Madoc, Ont., suggest there is potential for a small (200-ton-per-day) underground mining operation, Micham Exploration (VSE) and Mono Gold Mines (ME) report.
>
> Reserves, classified as "modified geological" and calculated mainly from drilling and some underground sampling, are based on a minimum mining width of 6 ft and three cut-off grades:
>
> | Cut-off grade | Reserve tonnage | Cut grade (oz/t) | Uncut grade (oz/t) |
> |---|---|---|---|
> | 0.05 | 248,000 | 0.19 | 0.27 |
> | 0.08 | 211,000 | 0.21 | 0.3 |
> | 0.1 | 187,000 | 0.22 | 0.33 |
>
> Exploration to date has consisted of surface drilling, ramping to the 75-ft level in one area, underground drilling and drifting on the 75-ft level. Prior to the current program, about 1,200 ft of strike length had been explored by drilling; the current program has exposed 225 ft of strike length by underground ramping.
>
> The companies say further comprehensive exploration would cost about $4.5 million. Micham and Mono say they intend to seek the necessary funding for the work program, which would include extending the ramp from 75 ft to the 175-ft level."

Stewart Lake Resources Incorporated put down a decline on its graphite property on Desert Lake in Bedford Township. A news release, which the Resident Geologist received from the company on July 26, 1988, stated that the underground "program resulted in the mining of 3,000 tons of flake graphite ore to facilitate metallurgical testing, mill design work, and market analysis as the basis for a final feasibility study. 200 tons of ore have been trucked



SCALE
0
25 mi.
0
40 km
N
76°
77°
44°
LAKE ONTARIO
OTTAWA
ST. LAWRENCE RIVER
OTTAWA RIVER
PRESCOTT
RUSSELL
GLENGARRY
STORMONT
DUNDAS
CARLETON
OTTAWA-CARLETON
GRENVILLE
LEEDS
LANARK
RENFREW
FRONTENAC
LENNOX
ADDINGTON
HASTINGS
PRINCE EDWARD
NORTHUMBERLAND
PETERBOROUGH
VICTORIA
HALIBURTON
DURHAM
BANCROFT
PEMBROKE
RENFREW
ALMONTE
CARLETON PLACE
BROCKVILLE
CORNWALL
HAWKESBURY
ROCKLAND
ALEXANDRIA
LINDSAY
PETERBOROUGH

Figure 18.2
Southeastern Resident Geologist's District

EXPLANATION

▨ District Boundary

Exploration Activity in Southeastern District, 1988

▲ Advanced exploration site

* Exploration site

+ Area where claims were staked in 1988

Note: Numbers are keyed to Table 18.2

TABLE 18.2. EXPLORATION ACTIVITY 1988.

MAP NUMBER	COMPANY	PROPERTY NAME	LOCATION (TOWNSHIP)	COMMODITIES SOUGHT	NOTES
1	Belmar Resources Inc	Ackerman Prospect	Marmora	Gold, silver	Diamond drilling 1987.
2	Black Hawk Mining Inc and Lodi Metals Inc	Timmins Mine	North Burgess	Graphite	This 'Timmins Mine', a former producer, w being stripped and trenched in autumn, 19 Recent work on the property includes diam drilling, sampling/ testing, and geol. mapping. Drill-indicated and inferred reserves of 1 million tons @ 8% graphite
3	Byer, J. and Young, C.R.	Queensboro Talc	Elzevir	Talc	Diamond drilling was carried out in 1988.
4	Cathedral Gold Corporation	Addington or Golden Fleece Mine	Kaladar	Gold, silver	Diamond drilling 1987-1988 by Michele Gold Mines Limited outlined reserves in the 'D' zone. Over 24000 feet diamond drilling carried out by E&B Explorations Inc in 1981-84. Total geological reserve indicated by past work: 785,000 tons @ 0.13 oz Au/ton
5	Cominco Ltd and Platinova Resources Ltd	Deloro Wollastonite	Marmora	Wollastonite calcite	10,000 ft diamond drilling, stripping, test pit and bench testing. Open-pit reserves: 450,000 tons @ 47% wollastonite, another zone of 680,000 tons inferred ore @ 39% wollastonite. Production decision expected toward end of 1988.
6	Dubbelstein, A., Mangrove Bay Resources Inc		Mayo	Dolomite	This property has been under exploration for several years. Diamond drilling was carried out in 1988.
7	Easton Minerals Ltd		Griffith Township	Dolomite	Diamond drilling and stripping were carried out in 1988, to outline this dolomite deposit.
8	Faith Mines Ltd	Old Diamond Mine, Blakely Mine, Canada Sulphur Ore, Gawley	Madoc, Marmora	Gold, silver, copper, zinc	Geochemical surveys and diamond drilling have been carried out by this company on several properties.
9	Gateford Resources Inc	Cooper Gold	Madoc	Gold	Stripping and diamond drilling in late 1987. Diamond drilling was again under way in November, 1988.
10	Harwin Exploration and Development Inc	St. Joe	Madoc	Gold, silver	Geophysical, geological, and geochemical surveys were carried out in 1987.
11	Homestake Mineral Development Co		Clarendon, Darling, Grimsthorpe, Lavant	Gold, silver	This company is exploring a number of properties in Eastern Ontario.
12	I.K.O. Industries Ltd		Madoc	roofing granules ('andesite')	A bulk sample was removed in 1987, and a licence to operate was acquired in 1988 under the Pits and Quarries Control Act. Diamond drilling was carried out in 1988.
13	Kinbauri Gold Corp		Darling	Gold	Magnetometer and VLF surveys were done in 1988.
14	Mangrove Bay Resources Inc	Raglan Hills Diorite	Raglan	Platinum Group Elements, Copper, Nickel	Geophysical and geochemical surveys have been carried out.
15	McArthur Hills Explorations Ltd	Raglan Hills Diorite	Raglan	Platinum Group Elements, Copper, Nickel	Magnetometer and electromagnetic surveys have been carried out.
16	Micham Exploration Inc, Mono Gold Mines Inc	Bannockburn Mine, and new deposit to the northeast	Madoc	Gold, silver	Underground exploration was carried out in 1988 to the 75-foot level, with underground drilling and drifting on the 75-foot level. 'Modified geological' reserves over minimum mining width of 6 feet: 248,000 tons @ 0.27 oz/ton Au (uncut)

TABLE 18.2. CONTINUED.

MAP NUMBER	COMPANY	PROPERTY NAME	LOCATION (TOWNSHIP)	COMMODITIES SOUGHT	NOTES
17	Mill City Gold Inc, Gunnar Gold Inc	Cordova Mine	Belmont	Gold, silver	1980-82, heap leaching and small-scale open-air cyanidation of ore tailings. Some gold was produced then. At least 19,000 ft diamond drilling was done in 1987-1988.
18	Noranda Inc	Malone Gold Prospect	Marmora	Gold	Trenching, channel sampling 1986. Diamond drilling, more channeling 1987. More diamond drilling was planned for the autumn of 1988.
19	Norlode Resources Inc		Cardiff	Rare Earths	Geophysical surveys and surface sampling were carried out in 1987.
20	Northgate Exploration Ltd		Lutterworth	Zinc	Geophysical and geochemical surveys have been carried out.
21	Novamin Resources, Eldor Resources	Cadieux, Renprior prospects	Admaston	Zinc, lead	Stripping, much diamond drilling have been carried out in recent years. This deposit is known as the 'Renprior' and 'Cadieux' properties.
22	Pipawa Explorations Ltd & Jayfran Enterprises		Dungannon	Nepheline Syenite	The possibility of producing alumina and silica chemicals from rock on this property is being studied.
23	Quill Resources Inc, United Reef Petroleums		Barrie	Gold	Diamond drilling was carried out in 1988.
24	Sands Minerals Corp, Banirwin Mining&Expl Ltd	Ore Chimney	Barrie	Gold, silver	Trenching, 4000 feet diamond drilling in 1987
	Steep Rock Resources Inc			Various industrial minerals	This company explores every year for industrial minerals in Eastern Ontario.
25	Stewart Lake Resources Inc.	Kirkham, Bawden Graphite Properties	Bedford	Graphite	Kirkham property acquired by option, much other ground staked. Underground expl., extraction of test material, pilot plant beneficiation, distribution of samples to potential customers completed 1988. Main zone five million tons @ 7.6% graphitic carbon.
	Stoklosar Marble Quarries Inc		Madoc	Marble chips	This terrazzo chips producer explores for building stone every year.
26	Two Lakes Marble Incorporated		Griffith	Dolomite dimension stone	In 1988, test blocks were being extracted. Two large areas had been stripped. The property was previously explored by Trisar Resources Ltd, as a source of dolomite filler.
27	United Reef Petroleums Ltd		Anglesea, Barrie, Grimsthorpe	Gold	This company is exploring several properties.

to the Ontario Research Foundation in Mississauga who have been awarded the final metallurgical and pilot plant testing work to establish the mill criteria."

The Northern Miner (June 27, 1988) reported that:

> "... Stewart Lake President Richard Scratch says the graphite concentrate, which reaches greater than 90% purity through simple flotation, can be upgraded to as high as 97.6% purity. At that purity, the material could command a price of about $2,000 per ton...
>
> After drilling 140 holes from surface in three zones, Stewart Lake has drill-indicated reserves in its Main zone alone of five million tons averaging 7.6% graphitic carbon...
>
> The Main zone is open along strike in both directions and at depth. All reserves are calculated above the 500-ft horizon.
>
> There are two other zones that have been partially traced and 12 geophysically detected zones still to be tested."

The underground phase of exploration ended in early July 1988. A prefeasibility study was completed, and exploration continued to the end of 1988. The Northern Miner (October 17, 1988) reported:

> "The study, completed by Kilborn Ltd., a consulting engineering company, concludes that a viable mining operation is possible and suggests that a detailed feasibility study be completed.

TABLE 18.3. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

YEAR	CLAIMS RECORDED	CLAIMS CANCELLED	CLAIMS ACTIVE	DIAMOND DRILLING (Man Days)	GEOPHYSICAL SURVEYS (Man Days)	GEOLOGICAL SURVEYS (Man Days)	OTHER WORK (Man Days)	TOTAL MAN DAYS CREDITED
1980	548	721	1699	17648	6665	2822	3584	30719
1981	485	758	1531	11855	4041	4022	4699	24617
1982	354	617	1115	9546	8372	481	8927	27326
1983	391	377	1157	8317	2840	3135	5032	19324
1984	555	498	1254	9928	23500	322	3786	37536
1985	457	360	1312	15619	3192	650	5937	25398
1986	744	426	1579	15829	3623	3843	9304	32599
1987	619	526	1641	6672	24592	5721	5352	42337
1988 to November 30, 1988	897	394	2167	17184	24305	2264	8380	52133

> The prefeasibility study was modeled on a 300-350-ton-per-day operation capable of producing 12,000-14,000 tons of graphite concentrate per year. Kilborn will complete the feasibility study by year end, Stewart Lake says."

Late in 1988, the company located a significant faulted extension of the number one zone in drillholes. Intersections of 9.4 percent graphitic carbon over 33 feet and 11.5 percent graphitic carbon over 20.5 feet in the first two holes indicate an additional strongly mineralized zone that is readily accessible from the present workings (Stewart Lake Resources Incorporated, press release, November 14, 1988).

I.K.O. Industries Limited acquired a licence under the Pits and Quarries Control Act for their proposed andesite roofing granules operation west of Madoc.

Two Lakes Marble Incorporated tested their dolomitic marble property in northern Griffith Township for dimension stone. The company stripped several areas, and extracted large test blocks.

EXPLORATION ACTIVITY

Exploration activity focused on industrial minerals and precious metals. Although much exploration in Southeastern District takes place on patented land, it was possible to identify 33 active exploration sites.

There were 2167 active claims in Southern Ontario Mining Division on November 30, 1988. Claim staking activity is shown for Southern Ontario Mining Division in Table 18.3. Southern Ontario Mining Division includes the Algonquin, Southeastern, and Southwestern districts of the Ministry of Northern Development and Mines, but most claim staking activity in southern Ontario takes place in the Southeastern District.

Gold exploration was concentrated in Belmont, Madoc, Marmora, and Kaladar townships, but other areas such as Barrie, Clarendon, and Kennebec townships, and the Robertson Lake shear zone area in Lavant and Darling townships were also being explored.

Several graphite prospects were under examination. Stewart Lake Resources Incorporated's Desert Lake, or Kirkham, Property was described in the Advanced Exploration and Development section. Black Hawk Mining Incorporated and Lodi Metals Incorporated were exploring the "Timmins Mine" in North Burgess Township. The Northern Miner (September 12, 1988) reported that "work by Lodi has outlined a drill-indicated and inferred reserve of one million tons grading 8% graphite." The same article stated that Black Hawk can earn a 55 percent interest in Lodi's graphite property by spending $1.25 million on the property by September 1, 1991. Late in 1988, Lodi-Blackhawk were doing extensive backhoe trenching and were planning to blast a small pit for bulk sampling.

RESIDENT GEOLOGIST'S AND STAFF ACTIVITIES

The Resident Geologist provided a consultative technical service to companies and people engaged in mineral exploration and mining development in southeastern Ontario. This service involved consultations in the office and in the field, and use of the Resident Geologist's library, files, and computer systems. The Tweed and Bancroft Drill Core Libraries were also used extensively by the Resident Geologist's clientele.

The Resident Geologist served on the Information Technology subcommittee. This committee dealt with MNDM's computer and information management systems.

The Resident Geologist and his staff visited selected mineral properties, either because of their importance to Ministry programs, or because of interest in, or work by, mining and exploration companies. Careful examination of properties under development, especially industrial mineral properties, was emphasized.

The Regional Specialist, H.D. Meyn, has an office at Bancroft, and was assisted in 1988 by K. Fell, Secretary, and one summer student. The Regional Specialist is separate from the Resident Geologist program and in 1988 carried out independent research on Precambrian carbonate rocks. Claim tags, prospector's licences, and publications are sold at his office, and his library is available for public use.

A variety of services are available from the Southeastern District Resident Geologist:

1. Technical consultations in the field, in the office, and by telephone
2. Use of the Assessment Files, Mineral Deposit Files, the library of maps, government reports, other printed material, and the associated computer data bases located at Tweed
3. Use of Drill Core Libraries at Tweed and Bancroft for examining archived drill core, and for logging newly drilled core
4. Geological maps and reports, claim maps, and prospector's licences are sold by the Resident Geologist's secretary

Southeastern District staff each year provide, on request, a limited number of geology and mining related talks and field trips to various groups. In 1988, talks were given to the Quinte Gem and Mineral Club, to the Kiwanis Club of Belleville, and to campers at Silent Lake Provincial Park. Talks and field trips were provided to the Harding Lake Junior Rangers, and to a high school class from St. Catharine's, Ontario.

Booths were set up at the Bancroft Gemboree and the Wilberforce Rockhound Fair at which geologically oriented publications, issued by the Ministry of Northern Development and Mines, were on sale. The Ministry of Northern Development and Mines sponsored D.H. Gorman, formerly Professor of Mineralogy, University of Toronto, at these two events to identify rocks and minerals for the rockhounds.

RESEARCH BY RESIDENT GEOLOGIST, STAFF, AND REGIONAL SPECIALIST

BUILDING AND ORNAMENTAL STONE

by D.A. Williams and R.R. Wolf

This project is in the final year of a three–year, COMDA–funded program to identify potential dimension stone quarry sites in southeastern Ontario and to promote their development. Both Precambrian (granite and marble) and Paleozoic (limestone and sandstone) rocks are being studied.

Geological mapping of Precambrian sites has been completed and a final report, "Building Stone Potential in Eastern Ontario" (LeBaron *et al.*, in press), was written during 1988. The report recommends areas within the Ontario Gneiss Segment with potential for granite, and areas within the Central Metasedimentary Belt with potential for granite and marble.

Geological mapping of the Paleozoic stratigraphic units of the St. Lawrence Platform which showed potential for dimension stone (limestone of the Gull River and Bobcaygeon formations, and sandstone of the Nepean Formation), was conducted during 1988 by D.A. Williams. Drillholes to basement were logged by D.A. Williams and R.R. Wolf, as follows: Pickering (Pickering Township), Eldorado (Madoc Township), and Coboconk (Somerville Township). The latter hole was drilled for the Ministry of Northern Development and Mines by Sir Sandford Fleming College, Lindsay, in April 1988. The drill crew was supervised by K.R. Fickling, Drill Crew Supervisor, Sir Sanford Fleming College. The drillhole intersected the Shadow Lake and Gull River formations close to their type localities, and the core is stored at the Tweed Drill Core Library.

A report, by R.R. Wolf, evaluating the economic potential of the Paleozoic rocks in southeastern Ontario is in preparation. In addition to dimension stone, the report will evaluate cement, lime, lithographic stone, brick and tile, silica sand, and gypsum potential, and vein and stratiform deposits (calcite, fluorite, barite, celestite, galena, sphalerite, hematite, siderite, chalcopyrite, and uranium–bearing minerals). Geological and commodity maps at a scale of 1:250 000 will accompany the report.

A report on the Madoc fluorite area (including a page–size map) was included in "Summary of Field Work and Other Activities 1988" (Thompson and Williams 1988). A display by R.R. Wolf, D.A. Williams, and P.W. Kingston, entitled "Industrial Minerals in the Paleozoic Rocks of Southeastern Ontario", was shown at the Ontario Mines and Minerals Symposium in December 1988.

INDUSTRIAL MINERAL STUDIES

This industrial mineral project, funded under the Canada–Ontario (1985) Mineral Development

Agreement, is in the second year of an 18–month program. The objective of the project was to evaluate several potentially valuable industrial mineral commodities in Eastern Ontario, that are currently undeveloped. Commodities examined included graphite, talc, and Eastern Ontario industrial minerals with potential uses in steelmaking.

Graphite

by A. MacKinnon and S.J. Black

Geological field work, in 1988, consisted of examining the major graphite occurrences within the Frontenac Axis in southeastern Ontario.

Six major occurrences were investigated: the Globe Mine, 5 km south of Perth; the Cornell Property, 5.5 km east of Portland; the Timmins Property, 15 km southwest of Perth; the Burridge marble belt, 10 km west of Westport; the Desert Lake (Kirkham) Property, 15 km northeast of Verona; and the Bawden Mine, 15 km east of Verona.

Of these properties, four are currently undergoing active exploration: Cornell, Timmins, Desert Lake, and Bawden.

The occurrences are all located in an area of granulite facies metamorphic rocks in the Central Metasedimentary Belt of the Grenville Province (Wynne–Edwards 1972). They are within 10 km of the Westport–Canoe Lake Fault, a major structural feature that transects the Frontenac Axis from the northeast to the southwest, approximately 50 km north of Kingston.

The present investigation involves geological reconnaissance mapping at 1:10 000 scale, supplemented by assessment work and company data. The results of the survey suggest that all of these deposits can be considered to be of economic interest.

The Timmins, Burridge, Desert Lake, and Bawden occurrences all contain significant quantities of flake graphite hosted in crystalline marble and calc–silicates. The Globe and Cornell properties are hosted in siliceous marbles, and have appreciable quantities of "needle" graphite as well as equidimensional flake.

This year's work has been described in Black and MacKinnon (1988). A display of maps, photographs, and cut samples of graphite mineralization was shown at the Ontario Mines and Minerals Symposium in December 1988. The final results of this work will be published in an open file report, planned for release in 1989.

Talc

by P. LeBaron

This project is part of a COMDA–funded investigation of industrial minerals in eastern Ontario. A study of ultramafic–hosted talc occurrences in a belt of Tudor Formation metavolcanics extending from Elzevir to Cashel Township was completed during the 1988 field season. Geological mapping at 1:10 000 scale was extended northward from the 1987 map area into Cashel Township in order to delineate talc–bearing zones and to subdivide the mafic metavolcanics into tholeiitic basalts, komatiitic basalts, and ultramafic komatiites as described by LeBaron *et al.* (1987).

Beneficiation tests were done on diamond–drill core samples from three talc occurrences. Flotation of the ground samples gave talc products of moderate to high quality with about 90 percent dry brightness, recoveries of 75 to 90 percent, and talc yield of 24 to 47 percent. The products have potential application in the paint, plastics, and paper industries.

A zone of altered ultramafic rocks in Kaladar Township, similar to those in Cashel Township, was briefly examined. The rocks are altered to anthophyllite–talc–carbonate assemblages and should be further investigated as potential talc exploration targets.

A report of the 1988 field work and beneficiation tests has been published (LeBaron 1988), and a paper on this work was presented at the Ontario Mines and Minerals Symposium in December 1988.

Fluxes and Synthetic Steelmaking Slags

by P.W. Kingston and W.F. Caley

This project was carried out by the Ontario Ministry of Northern Development and Mines, in part under COMDA. The purpose of this project was to examine possible areas in the steelmaking industry in which increases in consumption of Ontario industrial minerals might be encouraged.

One of the less well known areas of industrial mineral use is in the area of fluxes, slags, and specialty components for the steelmaking industry. This is an industry undergoing restructuring, rationalization, downsizing, and modernization. This industry is also one in which great opportunities exist for the development of new materials, such as special–composition refractory bricks, and for the introduction of new reagents and components, such as fluxes, synthetic slags, and refractory brick ceramic coatings.

Overall, the steelmaking industry is large, and uses relatively large tonnages of industrial minerals. Acceptance of small percentage increases in the use of a particular mineral, or the substitution of a relatively small percentage of an imported industrial mineral, throughout the steel industry, would result in utilization of significantly increased quantities of domestic industrial minerals. This high leverage effect makes the steelmaking industry deserving of our attention as far as industrial mineral promotion is concerned.

This project has focused, in particular, on the use of the industrial minerals wollastonite and nepheline as substitutes for fluorspar in the formulation of synthetic slags for secondary steelmaking. Most of our work to date has focused on the mineral nepheline, with the work on wollastonite still in progress.

The research components of this project have been carried out at the Technical University of Nova Scotia because of the special expertise developed in this area by W.F. Caley and his staff at the Department of Mining and Metallurgical Engineering, and because of the excellent research approach and willingness to engage in plant–scale testwork by Sydney Steel (SYSCO) at their plant in Sydney, Nova Scotia.

Sydney Steel operates an integrated steelmaking facility using the open hearth process. Following the open hearth, the molten steel is further refined in a second stage, called secondary steelmaking or ladle metallurgy. There are several things that are achieved in this process which include: degassing and desulphurization of the melt, removal of undesirable oxides and sulphides, control of residual inclusion morphology, and control of mechanical properties of the finished steel.

Ladle metallurgy, as the name implies, is carried out in a ladle after the initial refining process. This batch process allows steelmakers to exercise a high degree of control on the physical and chemical properties of each ladle–full of steel.

Between one and two tons of a synthetic slag are added to each ladle of molten steel. SYSCO uses a commercial, synthetic, calcium aluminate material (Coflux) plus lime and fluorspar as their synthetic slag.

Although fluorspar is an excellent fluidizer, and is an essential component in the synthetic slag system, there are several serious problems which do exist with extensive use of fluorspar in steelmaking. Fluorspar attacks and corrodes most ladle refractories. Fluorspar, when heated and reacted in the ladle, gives off toxic fluorine–containing species to the atmosphere. In addition, fluorspar is a relatively expensive industrial mineral, currently costing approximately $100.00 per ton for metallurgical grade. If the fluorspar concentration was decreased and the basic oxide concentration increased, a comparable level of fluidity of the molten silicate network should be maintained. Thus, it could be advantageous to partially replace fluorspar with another suitable mineral. The bulk of such a mineral should be basic oxide in nature, in order to satisfy the fluxing requirements, and yet, should be both economically favorable and readily available.

Our work to date has concentrated on using nepheline syenite tailings from the Indusmin Mine at Nephton, Ontario, and to a lesser extent wollastonite and a natural wollastonite–calcite mixture from the Deloro area, to replace fluorspar.

TABLE 18.4. SYNTHETIC SLAG COMPOSITIONS USED IN VISCOSITY EXPERIMENTS (WEIGHT PERCENT).

RUN#	Coflux	CaO	CaF_2	N.S.T.*
A1	45	45	10	0
A2	45	45	10	0
A3	45	45	10	0
B1	45	45	5	5
B2	45	45	5	5
C1	45	45	0	10
C2	45	45	0	10
C3	45	45	0	10
Coflux	100	0	0	0

* N.S.T. : Nepheline syenite tailings

In our research work, a number of viscosity–temperature profiles were carried out using nepheline syenite tailings as partial and complete replacements for fluorspar in a calcium aluminate–lime–fluorite synthetic slag. Synthetic slag compositions used in the viscosity experiments are shown in Table 18.4.

Eight viscosity–temperature profiles of three synthetic slags were generated. The slags were produced by substituting nepheline syenite tailings for part or all of the fluorspar in a typical steelmaking synthetic slag. Two tests to compare the extent of refractory corrosion caused by two of these synthetic slags were also completed.

The corrosion of the refractory brick using the series B composition, (5 wt% NST (nepheline syenite tailings) and 5 wt% CaF_2), was slightly less than that of the base run, series A, (10 wt% CaF_2).

The viscosity–temperature profiles produced indicate that the series B synthetic slag exhibits superior fluidity over the temperature range investigated.

The chemical analyses indicate a loss of approximately 20 percent of the original fluorine present, due to volatilization in both the series A and B synthetic slags; series C slag (10 wt% NST) had a negligible fluorspar content to begin with.

Therefore, in the series B synthetic slag, there is an excellent possibility that the nepheline syenite tailings actually stabilize the fluorspar by forming a low melting, alkali compound, thereby enhancing the fluorspar's capability as a fluidizer.

At this time, further research is under way and there appears to be an excellent opportunity for introducing nepheline syenite as a partial replacement of fluorspar in synthetic steelmaking slags.

BURIED SAND AND GRAVEL LAND FORMS IN PORTIONS OF THE COUNTIES OF NORTHUMBERLAND AND HASTINGS

by G.A. Gorrell

A COMDA funded program for the delineation of morphological land elements composed of sand and gravel, which are buried in portions of eastern

Ontario in the southwestern part of the county of Hastings, and the eastern part of the county of Northumberland, has been completed. These land elements have been divided into segments, which pass the requirements for specific products used in the construction industry. The division has also shown which parts of the land forms may be used as a communal water supply. The observations from the identified land forms show that a variety of processes were responsible for their formation.

Areas which have similar sedimentological characteristics have been assembled into groups called lithofacies. These lithofacies have been used to predict the three–dimensional extent of the land forms and to evaluate the potential use for portions of the features. These predictions were then confirmed or disproved with geophysical studies carried out under the direction of Lloyd Thompson, Regional Geophysicist, MNDM, Tweed, and by subsurface drilling.

The work indicated that many of the land elements are interconnected, that large volumes of material lie below the water table, and that distinctive parts could potentially yield large volumes of potable water.

The study has also shown that there are distinct and consistent transitions from one lithofacies to another. Since these transitions were found in all of the studied land forms, they have been used to ascertain the possible uses for each individual element.

Investigation has found also that the centres of many of the large hills in the Stirling, Trenton, and Murray hills consist of bedrock. In addition, the geologic models which have been developed for the land forms indicate that the hills have deep channels, filled with sand and gravel, crossing through them. Seismic studies and drilling have located many of these channels. However, on the surface of many of the hills, the channels cannot be distinguished for they are overlain by tills thought to be of basal origin, shoreline sediments, and silt and clay.

GEOLOGY OF EGAN CHUTES PROVINCIAL PARK

by W.T. Grant

Egan Chutes Provincial Park is a newly created provincial park, located 11 km east of Bancroft along Highway 28. The park was created with the intention of providing the public with access to the York River and its three rapids, and to allow mineral collectors and geologists access to the interesting and varied geology of the area.

The main geological feature in the park area is a north–trending band of nepheline syenite. Within the nepheline syenite gneiss are numerous zones of nepheline–albite pegmatite. The gneiss is in contact to the east with marble and marble skarn, which are in contact farther east with a large metagabbro body. West of the nepheline gneiss band is a narrow marble unit. West of this marble is a large granitic intrusion which contains marble pods that may be up to 1 km in length.

It is believed that the creation of a provincial park at this location will enhance the mineral collecting opportunities in the area and hence increase the economic benefit of mineral collecting to the Bancroft area. A preliminary map describing the detailed geology of the park area will be published in 1989.

STRATIGRAPHY AND SEDIMENTATION OF CARBONATE AND ASSOCIATED METASEDIMENTARY ROCKS OF THE GRENVILLE SUPERGROUP IN SOUTHEASTERN ONTARIO

by H.D. Meyn

INTRODUCTION

The carbonate rocks of the Grenville Province in Ontario have a long history of contributing to the mineral production of Ontario. There are about 650 known mineral occurrences in the Grenville marbles. Of these, about 60 are past or presently producing mines of minerals such as iron, mica, talc, graphite, zinc, magnesium, building stone, and marble for filler.

Economic potential is seen for future additional production of marble, and marble–hosted talc, tremolite, and wollastonite for mineral fillers, as well as additional graphite, and zinc production.

In 1988, field work was concentrated on the Belmont Lake area, Belmont Township, Peterborough County.

BELMONT LAKE FORMATION

During the mapping undertaken by Bartlett and co–workers, the predominantly epiclastic rocks in southern Belmont Lake were named the Belmont Lake Formation (Bartlett *et al.* 1982). The relationship of this formation to the underlying, overlying, and laterally equivalent rocks is not clearly defined.

A pervasive schistosity is developed in all of the rocks of the Belmont Lake area. This foliation is not sufficiently severe to have destroyed all original structures. Sedimentary structures such as bedding, down to very finely laminated mudstones and dolostones, cross–bedding, and graded bedding are well preserved. Strike direction is generally just east of north. Stratigraphic tops are consistently eastward. Bedding is locally vertical to overturned, but dips are generally between 30° and 70° east. Indication of paleocurrent direction from cross–bedding is generally eastward.

This summer's field work suggests that the Belmont Lake Formation is composed of a series of fining upward cycles. A typical fining–upward cycle on Belmont Lake starts with conglomerate. The conglomerate is followed by cross–bedded sandstone and pebbly sandstone. The sandstone in turn is followed by ever finer sandstone, grading upward into siltstone and culminating with laminated mudstones. Where conditions were suitable, the clastic sequence is topped by stromatolitic dolomite.

Such a typical fining–upward cycle is rarely complete in any single section because of lack of continuous outcrop in the study area. Further, each cycle is not always complete in every instance, nor were conditions favorable for formation of the stromatolitic dolomite at the top of each cycle nor along the whole strike length of a cycle.

The author believes that a general model for the environment encountered at Belmont Lake might be a volcanic island, or chain of islands, surrounded by a relatively narrow, shallow–water carbonate shelf on which carbonate deposition takes place whenever clastic or volcanic–pyroclastic events do not predominate. Such an environment would allow all of the observed volcanic and sedimentary facies to co–exist in close proximity.

Further study will increase the understanding of the paleoenvironment of the carbonate and clastic metasediments in the Central Metasedimentary Belt of the Grenville Province in Ontario and the mineralization environments associated with these rocks.

RESIDENT GEOLOGIST'S INFORMATION SYSTEMS

by S. van Haaften

An important function of the Resident Geologist's Office is the maintenance and dissemination of a variety of information. Since 1985, IBM PC[1] and compatible micro–computers have been used in Tweed to manage much of this information.

dBase III Plus[2] data base management software and Inmagic[3] text retrieval software are the Resident Geologist's main information management tools. Information about mineral occurrences, assessment files, library materials, scientific papers, and diamond–drill core is stored in computer data bases.

Tweedmin Mineral Occurrence Inventory

The Tweedmin mineral occurrence inventory uses dBase III Plus. Beginning in 1985, the existing paper–based mineral occurrence files in Tweed were upgraded and made accessible by computer. The files contain a folder for each known mineral occurrence in the Southeastern District, containing a data–entry summary sheet, topographic and geology maps showing the occurrence's location, and photocopies of reference material. The files also contain information obtained from the Provincial Mineral Deposit Inventory, and from the National Mineral Inventory.

The mineral occurrence file folders are arranged in drawers, alphabetically by township, and numerically by concession and lot within each township. Many users of the files are only interested in a specific geographic area, and manually search the files.

Other users want to search all the files for a commodity, a mineral, a rock type and mineral combination, or similar search criteria. These users employ the Tweedmin program, which allows very fast searching of the computer data base using a simple menu. Searches which are not programmed can be done by the Staff Geologist.

The Tweedmin system contains a main data base with all information, plus a second, smaller data base which speeds up searches. Data are coded on data–entry sheets and then added to the main data base. After a data–entry session is complete, a program called "rebuild" is run, which rebuilds the second data base and re–indexes the computer files, so that the newly added data can be accessed by the Tweedmin program.

Tweedmin is a simple, effective system which is regularly used by clients and office staff. On November 29, 1988, Tweedmin contained records for 2138 mineral occurrences. A total of 587 more data–entry sheets had been completed and were awaiting data entry. The Tweedmin computer data base will eventually contain more than 3000 mineral occurrence records.

MDI Geoscience Database for Micro–Computers

This data base, containing information for 5770 mineral deposits from all over Ontario, was released as a publication by the Ontario Geological Survey in October 1988 (Geoscience Data Centre 1988). The MDI program, with a data subset for southern Ontario, is kept on a computer in Tweed. The main differences between MDI and Tweedmin are:

1. Tweedmin is directly keyed to the Resident Geologist's paper files, whereas MDI is not
2. MDI contains about half as many records for a given area as Tweedmin. MDI records contain well–verified data for sizable mineral occurrences, whereas Tweedmin contains many additional occurrences about which little is known

MDI and Tweedmin complement each other well within the Resident Geologist's Office, because with MDI, it is possible to maintain information about the entire province. It is expected that, in the future, OGS will use data from district data bases such as Tweedmin to update and expand MDI.

Assessment File Index Program

Developed by A. Anderson, Technology Development Officer, MNDM, Kenora, to work with dBase

II[2] on an Apple IIe[4] computer, this system was adopted in 1986 by the Resident Geologist in Tweed. Data for all the district's assessment files (502 files in 32 townships) were coded and entered into a computer at that time. In January 1987, the Resident Geologist's District increased by 80 townships, and staff time has not since been available to update the assessment files data base.

The Assessment File Index Program is being revised by its author to work with dBase III Plus. Tweed staff will adopt the revised system when it becomes available, and add more assessment files into the data base as time permits.

Libdb Library Data Bases

In January 1987, a project was begun to consolidate and inventory the Resident Geologist's collection of books, reports, and scientific journals. Several dBase III Plus data bases were built for this purpose, and used to print labels for book cards and pockets, and to print a shelf list.

This project was completed by August 1987. New additions to the collection are added to the data bases every few months.

Artic, a Scientific Papers Data Base

The Resident Geologist's collection of photocopied scientific papers was organized in 1987 and 1988 using Inmagic text retrieval software. By November 1988, there were more than 1700 records in Artic.

The Inmagic text retrieval software has proven to be very flexible in this application. For example, one can search the titles, subtitles, abstract, and key words fields simultaneously for a given word.

The Artic data base structure was developed by J. Heitshu of the Mines Library, OGS, in co–operation with the Tweed Resident Geologist's staff. The Resident Geologist at Tweed, the Regional Specialist at Bancroft, and the Mines Library all use the Artic system. The Resident Geologist at Dorset has purchased Inmagic software and will adopt Artic in early 1989. The Artic–Inmagic system has become a southern Ontario MNDM standard.

Drill Core Library Computer System

This turnkey system was written in compiled dBase III Plus by D. Guindon, Drill Core Library Geologist, Kirkland Lake, in co–operation with staff of the Information Technology Section of MNDM. Each Drill Core Library uses the system to catalog drill core and print reports.

PHD Geological Information Management System

Southern Ontario Region geological staff co–operated in 1986 to initiate a truly comprehensive Resident Geologists' information management system. This project resulted in the PHD system (Kingston *et al.* 1987). PHD was demonstrated to MNDM's Information Management Subcommittee in March of 1987 and was favorably received.

PHD used dBase III Plus on an IBM PC–compatible computer, but the program, while useful, worked too slowly with this hardware and software to be practical. Data entry was especially slow, because the system placed information into many separate data base files, and because many indexes needed updating. PHD showed that a fully integrated geological information management system would be practical using a sufficiently powerful computer.

Other Data

Southern Ontario Region staff have placed other data on computer. Some additional computer data, and newly developed systems, are described below.

V.C. Papertzian, Drill Core Library Geologist, Tweed, is setting up a computer system to catalog the Resident Geologist's rock samples, thin and polished sections, and assays relating to the rock samples. A data base of more than 1700 multi–element analyses of Grenville carbonate rocks already exists in Tweed. This data base provides input data sets to geochemical data processing and plotting programs. The Tweed office also has a data base of 434 building stone localities for southeastern Ontario (Verschuren *et al.* 1985). Tweed staff maintain data bases of mining and exploration activity to provide information for the Resident Geologist's annual report.

H.D. Meyn, the MNDM Regional Specialist at Bancroft, obtained the full Tweedmin data set in Inmagic format in February 1988. This Inmagic mineral occurrence data base uses a structure called Mindep, developed by the Regional Specialist. The Mindep–Inmagic data base was edited by the Specialist, and is used in his study of carbonate rocks. The Specialist's secretary, K. Fell, developed a data base for color slides using Inmagic, and cataloged the Specialist's collection of approximately 3000 color slides.

Future Plans

The existing computer data bases at Tweed cover most of the office's information management needs. Data coding and data entry will continue for information which is not yet in the existing systems. Almost all data coding and data entry has been done by staff employed on Section 38 Special Employment Programs, and successful completion of the data bases will depend on availability of qualified staff through Section 38 or other programs.

The next step will be to bring all Libdb library data and Artic scientific papers data into one data base under Inmagic, to allow convenient searching of all published information in the office. This work will start with conversion of existing Libdb data to

Artic. Much additional information will need to be entered, for Artic records contain more information than Libdb records. Additional Resident Geologist's information such as maps and mine plans will be added to the system.

The final step in district office data base creation will be to bring all our information into one system, accessible from a single, user interface. Ultimately, district and provincial data bases should be integrated, with all data being available at any MNDM office, or by modem on a client's computer. These goals will require much work, and more powerful computer hardware and software than is now available to the districts.

The main data base computer from the Tweed office was used in a display at the Ontario Mines and Minerals Symposium in December 1988 to demonstrate these information systems.

Trademark information:

[1] IBM and PC are registered trademarks of International Business Machines Corporation.

[2] DBase II and dBase III Plus are registered trademarks of Ashton–Tate.

[3] Inmagic is a registered trademark of Inmagic Incorporated.

[4] Apple IIe is a registered trademark of Apple Computer Incorporated.

GEOPHYSICS

by L.G.D. Thompson

Introduction

The Office of the Regional Geophysicist primarily conducts geophysical surveys in support of the geology projects conducted under the Resident Geologist, Ministry of Northern Development and Mines, Tweed, and also for other ministry regions, districts, and agencies on request.

In 1988, seismic field surveys totaling 18.6 km constituted most of the geophysical work completed. Two kilometers of magnetic, 1.8 km of gravity, 1.1 km of resistivity, and 1.1 km of alpha–meter surveys were also completed. Three backhoe test pits were dug and numerous auger test holes were drilled.

Geophysical Study of Fluorite Deposits

The geophysical study of the fault system associated with the fluorite deposits in the Madoc area (Kingston and Papertzian 1986; Williams and Thompson 1986; Thompson and Williams 1987) was continued in 1988. This work was done in conjunction with a study of the structural setting of fluorite deposits conducted by D.A. Williams, Project Geologist, Tweed, under the COMDA–funded Unconformity Study Project.

At O'Hara Mill (a previous fluorite study site on the 5–6 sideroad, Concessions III and IV, Madoc Township), an additional 360 m of seismic, 580 m of magnetic, 1810 m of gravity, 250 m of resistivity, and 300 m of alpha–meter surveys were completed in 1988. The gravity survey was performed by staff of the Geophysics/Geochemistry Section, Ontario Geological Survey, Toronto. Numerous auger holes were drilled to test bedrock depths. A backhoe test pit, dug to identify an unknown Precambrian basement rock, unfortunately failed to reach the Precambrian rock. The results of all geophysical work completed at this site are fully reported in a published paper (Thompson and Williams 1988).

At Buller (a previous fluorite study site on the Concession IX road, Hungerford Township), two backhoe test pits were dug to determine the cause of conductivity and alpha radiation anomalies associated with the underlying Lower Bobcaygeon limestone bedrock. These pits showed that the layer above bedrock was not broken or weathered limestone as previously interpreted from the seismic data, but was a dense blue clay. A bedrock sample confirmed a competent layer of Lower Bobcaygeon limestone. Due to extreme water conditions in the pits, the cause of the anomalies was not determined.

At a new fluorite study site along the Crookston Road (Concession X road) across Lots 14 and 15, Huntingdon Township, 570 m of seismic and 650 m of magnetic surveys were completed in 1988. No anomalies of interest were noted.

At another new fluorite study site along the Concession VIII road, Hungerford Township, 990 m of seismic, 740 m of magnetic, 760 m of resistivity, 800 m of alpha–meter, and 1 km of elevation surveys were completed in 1988. The seismic work included three test lines to determine the seismic velocities of local granite gneiss, Lower Gull River limestone, and Lower Bobcaygeon limestone. Several auger holes were drilled to verify bedrock depths. Seismic results indicated a fault zone between Paleozoic limestone on the west and Precambrian granite gneiss on the east. Magnetic, resistivity, and alpha–meter results indicated an anomalous zone on strike with an interpreted fluorite–bearing fracture running southeast from Moira Lake near Madoc (Thompson and Williams 1988).

Buried Aggregates Project

A major portion of the summer seismic field work (two months) was in support of the COMDA–funded Buried Aggregates Project conducted by G.A. Gorrell, Project Geologist (COMDA), Ministry of Northern Development and Mines at the Eastern Region Office, Ministry of Natural Resources, Kemptville, Ontario. The purpose of the seismic survey work was to identify sand and gravel channels, if present, usually under thick layers of clay or till, at sites selected by the Project Geologist.

Under this project, 29 seismic profile lines, usually 600 m in length, and totaling 11 km were completed. The seismic lines were grouped into three different work areas identified as the Pancake Hill area, the Glen Ross area, and the Murray Hills area.

In the Pancake Hill area, eight profile lines were completed. Two lines were done primarily by the seismic refraction method using forward and reverse spreads 52 m in length. Six lines were done primarily by the reflection method using forward and reverse spreads 100 m in length.

In the Glen Ross area, 10 profile lines were completed. Two lines were done by the refraction method and 8 lines were done by the reflection method.

In the Murray Hills area, 11 profile lines were completed using the reflection method. Refraction measurements were also done for each line to provide overburden information.

The results for all profile lines were provided to the Project Geologist as vertical profile sections, showing the depths to gravel and till layers and to the bedrock surface.

Test Surveys for OGS and MNDM Southwestern District

At the request of the Aggregate Assessment Office, Ontario Geological Survey, Toronto, and the Resident Geologist, Southwestern District, London, test seismic surveys were carried out at the Pinehurst gravel deposit area east of Chatham, and the gravel deposit area northwest of Leamington. The purposes of these tests were to: (1) test the different seismic methods and determine the one most suitable for detecting and mapping the buried gravel layers in each area; and (2) survey a test seismic line at a site selected by the Project Geologist, Ontario Geological Survey.

At the Pinehurst site, 400 m of seismic test lines were completed to measure the seismic velocities of the different subsurface materials, and to evaluate the different seismic methods. The shear wave refraction method was found to be the most suitable for detecting and mapping the gravel buried under clay and till layers. A seismic survey line 600 m in length, running southeast to northwest approximately through the middle of the McCully farm, over a known gravel area, was completed using the shear wave refraction method. The seismic results gave a vertical profile section showing the depths to the gravel (where present) and the shale bedrock.

At the Leamington site, 500 m of seismic test lines were completed to determine the seismic velocities of the subsurface materials. Although other methods were tested, the conventional, pressure wave refraction method was found to be suitable for detecting and mapping the buried sand and gravel in this area. The selected seismic survey line ran south to north through several farm fields west of the inoperative Bondy Pit for a distance of 1.7 km. Along this survey line, seismic refraction measurements were made only at selected intervals. The seismic lines covered 580 m of the survey line. The seismic results gave a vertical profile section showing the variation in the subsurface materials going northward, and the depths to gravel and till layers. Bedrock was too deep to be identified.

Other Test Seismic Surveys

A test seismic survey was conducted on the farm of Stanley Geen, located just south of Plainfield on Lot 16, Concession V, Thurlow Township. The purposes were to: (1) gain information about the Paleozoic bedrock surface for mapping purposes, and (2) try out new seismic field survey techniques. Eleven seismic refraction spreads 52 m in length were completed along a north–south line approximately along the centre of four farm fields. The results from these lines gave a vertical profile section showing the depths to a till layer and bedrock surface (Bobcaygeon limestone). Using this information as a reference, a shear wave refraction technique was perfected for future surveys.

At the request of the manager of the Codrington Fish Culture Station, Ministry of Natural Resources, Codrington, Ontario, three seismic reflection lines 100 m in length and one refraction line 52 m in length were completed on the ministry property. The purpose of these tests was to determine the depth to the limestone bedrock, and thus the thickness of a layer of water–bearing gravel known to overlay the bedrock. The gravel layer was buried under about 30 m of clay. The seismic results showed that the bedrock was only about 16 m deep near an esker on the south, but dipped steeply to about 41 m near an existing drilled well to the north. The sand and gravel layer near the esker on the south was in the water table about 10 m below the surface and was about 6 m thick. To the north near the well, the sand and gravel layer was about 31 m deep and about 10 m thick.

Consultation Services

Geophysical consultation was provided to mineral exploration companies, government agencies, universities, and individuals on more than 20 occasions by phone and more than 25 occasions by office and field visits.

In December 1988, at the Ontario Mines and Minerals Symposium, the Regional Geophysicist presented a poster display and demonstration of seismic reflection data processing.

TABLE 18.5. SUMMARY OF BANCROFT CORE LIBRARY HOLDINGS.

TOWNSHIP	COMPANY	DEPTH DRILLED (M)	CORE STORED (M)	COMMODITY SOUGHT
Anstruther	Biron Bay Resources Ltd.	2600.8	2600.8	Fe, Ti
	Esso Minerals Canada	1008.0	972.2	U, Th
	Glen Explorations	181.4	2.7	U, Th
	Northgate Exploration Ltd.	384.3	339.0	U, Mo
Blithfield	Ontario Hydro	174.2	127.5	Structure
Brougham	Coronation Resources	529.1	307.7	Graphite
	Ontario Hydro	204.9	98.8	Structure
Burleigh	L.V. Lomas Chem Co. Ltd.	243.8	3.6	Marble
Butt	Vesuvius Crucibles	1248.3	1163.0	Graphite
Cardiff	Esso Minerals Canada	3558.1	3019.1	U, Th
	Griffis, A.T.	294.4	3.8	Graphite
	Kenmac Chibougamau Mines	691.3	396.2	U, Th
	Kerr Addison Mines Ltd.	10478.6	9691.3	U, Th
Cashel	David McMurray	290.1	285.6	Talc
Cavendish	Quebec Uranium Mines Ltd.	459.3	6.0	U
Dungannon	Jayfran Enterprises	365.8	354.8	Neph Syen
Faraday	Madawaska Mines	3234.3	632.6	U, Th
	Mercier Exploration	735.3	10.7	U, Th
Galway	Halas, Frank	504.4	6.0	U
Glamorgan	Esso Minerals Canada	943.1	732.0	U, Th
	Sulpetro Minerals Ltd.	373.7	373.7	Zn
Laurier	Trout Creek	161.8	131.0	Graphite
Limerick	Lac Minerals Ltd.	13281.6	9295.9	Cu,Ni,Co
Mayo	Falconbridge Ltd.	421.9	421.9	Fe
Methuen	Indusmin Ltd.	92.2	92.0	Neph Syen
Monmouth	Esso Minerals Canada	5256.1	4321.5	U
Monteagle	Esso Minerals Canada	192.8	177.7	U
	Forefront Uranium Mines Ltd.	609.8	205.2	U
	Hobbs, L.G.	220.8	1.6	U
Murchison	Comet Quartz	336.0	283.0	Quartz
Ryerson	Graphite Corp. of Canada	1338.0	1299.5	Graphite
	Ryerson Graphite	1113.0	1044.8	Graphite
Snowdon	Sulpetro Minerals Ltd.	11320.3	10600.2	Zn
Totals		62847.5	49001.4	

DRILL CORE STORAGE PROGRAM

BANCROFT DRILL CORE LIBRARY

by W.T. Grant

The Drill Core Library in Bancroft was staffed full time by W.T. Grant; A. Casselman worked as an assistant from May through August as part of the Experience '88 program.

Drill core from the northern part of the Southeastern District and also from the Algonquin District, is stored at the Bancroft facility. Individuals or companies are encouraged to use this facility to examine core library core, or to work with their own drill core. Table 18.5 summarizes core which is stored in the core library.

TWEED DRILL CORE LIBRARY

by V.C. Papertzian

The Drill Core Library was managed by V.C. Papertzian in 1988. D. Rajan acted as assistant in July and August as part of the Experience '88 program.

The following resources and services are offered at the Tweed Drill Core Library:

1. Drill core from southern Ontario
2. Core logs, property maps, level and section plans, and other information for many of the properties for which the core library has drill core
3. Facilities for logging and splitting core
4. Binocular and petrographic microscopes
5. Rock cutting and polishing equipment

As of December 1, 1988, 77 375 m of core were in the Core Library catalogue, and approximately 3500 m of recently acquired core had yet to be catalogued. Table 18.6 summarizes the library's holdings. During 1988, 2039 m of core were catalogued.

Major contributors of core this year were Harwin Exploration and Development Incorporated who contributed core from their Madoc Township Property located immediately south of Bannockburn, and

TABLE 18.6. SUMMARY OF TWEED CORE LIBRARY HOLDINGS.

TOWNSHIP	COMPANY	DEPTH DRILLED (M)	CORE STORED (M)	COMMODITY SOUGHT
ALICE	SITE INVESTIGATION LTD.	20.8	18.6	Engineering
ANGLESEA	ULTIMATE ENERGY RES.	398.6	256.7	Au
ATHOL	O.G.S. HOLE	63.5	62.9	Engineering
BARRIE	GRANDAD RESOURCES	913.8	894.8	Au
BARRIE	HENRY COOK PROPERTY	76.2	76.2	Pb,Zn,Ag,Au
BARRIE	ORE CHIMNEY MINE	1,369.5	1,337.2	Au
BELMONT	BLAIRTON IRON MINE	1,460.4	1,202.4	Fe
BELMONT	CORDOVA	2,875.3	2,489.6	Au
BELMONT	PERSHING IRON MINE	6,712.3	5,718.4	Fe
BELMONT	PREUSSAG	1,211.9	1,133.7	CaCO
CAMDEN EAST	ROBLINDALE QUARRY	17.0	16.8	Scientific
CHARLOTTENVILLE	OLIVER IRON MINING	5,290.4	1,891.5	Fe
CLARENDON	SELCO INC.	245.4	232.0	Zn
CLARENDON	ST. JOE'S EXPL. LTD.	905.0	905.0	Zn
DARLINGTON	ONTARIO HYDRO	18.8	7.3	Engineering
DURHAM	ONTARIO HYDRO	128.9	91.7	Engineering
EDWARDSBURGH	ONTARIO HYDRO	52.0	27.1	Engineering
ELMSLEY N.	GLOBE GRAPHITE MINE	698.2	634.0	Graphite
ELZEVIR	STEEPROCK	516.2	492.0	Talc
ERNESTOWN	BETHLEHEM STEEL CORP	185.9	185.9	Fe
GRATTAN	SITE INVESTIGATION LTD.	111.2	108.1	Engineering
HOPE	ONTARIO HYDRO	4,453.6	1,822.6	Engineering
HUNGERFORD	RAM PETROLEUMS LTD	157.9	157.9	Mica
KALADAR	C.R. YOUNG	153.3	126.9	Mica
KALADAR	E&B EXPLORATIONS INC	7,817.7	7,817.7	Au
KALADAR	J. BYERS	123.1	121.2	Feldspar
KALADAR	LACANA MINING CORP.	176.5	131.9	Mica
LANARK	SELCO CLYDE RIVER	1,448.3	1,267.4	Zn
MADOC	BANNOCKBURN MINE	260.6	177.8	Au
MADOC	DERRY, MICHENER, BOOTH	600.9	591.1	Talc
MADOC	FREEPORT EXPLORATION	3,192.6	2,244.3	Base Metals
MADOC	HARWIN EXPL. & DEVEL.	792.5	792.5	Au
MADOC	MONO GOLD MINES INC.	14,924.9	14,849.7	Au
MADOC	SAGER	1,562.3	1,330.1	Base Metals
MADOC	SSFC/OGS	107.3	107.3	Scientific
MADOC	SYNGENORE	3,438.4	2,388.8	Base Metals
MADOC	TWIN BUTTES	150.3	150.3	Talc
MARMORA	ACKERMAN	37.1	37.0	Au
MARMORA	BELMAR RESOURCES INC	374.1	361.0	Au
MARMORA	BETHLEHEM STEEL CORP	8,706.5	478.8	Fe
MARMORA	GOLD BROOKE EXPL.	795.0	810.9	Au
MARMORA	MARMORATON IRON MINE	4,080.5	3,602.5	Fe
METHUEN	PREUSSAG	190.6	175.7	CaCO
NORTH BURGESS	O.M.N.R.	51.6	51.6	Vermiculite
NORTH CROSBY	MTC WESTPORT DDH	32.0	32.0	Engineering
OLDEN	LYNX CANADA EXPL.	15,825.8	14,711.5	Zn
OPS	OGS/SSFC	155.1	149.3	Scientific
ORILLIA	SPARROW LAKE	18.0	16.9	Limestone
OTONABEE	MURRAY LITTLE PROPERTY	96.3	90.8	Engineering
PALMERSTON	FAIRFIELD PROJECTS	152.4	146.8	U
PRESCOTT	ONTARIO HYDRO	6.7	2.1	Engineering
RAMA	LONGFORD DRILLHOLE	33.8	7.0	Engineering
RAMSAY	J.M. BELL	665.4	665.4	Base Metals
SEYMOUR	ALLAN'S MILLS	3,530.8	3,170.1	Fe
SOMMERVILLE	MASON PROPERTY	31.7	5.2	Limestone
SOMMERVILLE	OGS/SSFC	28.0	28.0	Scientific
SOUTH FREDRICKSBURG	LENNOX GENERAT. STN.	107.5	107.5	Engineering
THURLOW	SITE INVESTIGATION LTD.	53.1	38.0	Engineering
TUDOR	WOLFEX EXPL. LTD.	75.8	75.8	Au,Ag
TYENDINAGA	ONTARIO HYDRO	207.4	159.7	Engineering
WENTWORTH PQ	BLACK GREGOR EXPL.	84.4	83.1	Graphite
WOODHOUSE	OLIVER IRON MINING	1,540.5	509.1	Fe
TOTALS		99,511.6	77,375.2	

Sands Minerals Incorporated who contributed eight diamond-drill holes from the Ore Chimney Property located in Barrie Township.

There were 120 visitors to the facility between January 1, 1988 and December 1, 1988.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Ontario Geological Survey performed field work in several areas of the Southeastern District in 1988. G.D. DiPrisco completed his field work for the COMDA-funded study of the Precambrian–Paleozoic unconformity. This year he worked in the Renfrew–Arnprior area, and in the Stony Lake area of Peterborough County.

J.S. Springer continued her studies of industrial minerals in eastern Ontario. This year she examined fault structures in the Renfrew–Arnprior area of the Ottawa Valley, in co-operation with G.D. DiPrisco. The objective of this work was to locate potential sources of mineral pigments within faults, and at the Precambrian–Paleozoic unconformity.

R.M. Easton studied stratigraphy and mineralization environments in the Central Metasedimentary Belt in the Grenville Province. This year he did field work in the Southeastern District along the Frontenac Terrain Boundary and along the Robertson Lake shear zone.

G.H. McFall continued to study the structure of Paleozoic rocks in Prince Edward County. This work was performed by OGS as its contribution to the Multiagency Group for Neotectonics in Eastern Canada (MAGNEC).

J. Dawson worked on the preparation of Aggregate Resource Inventory Papers for Anstruther, Burleigh, Chandos, Methuen, and Somerville townships.

Geological work done in 1988 by the Ministry of Northern Development and Mines, and by the Geological Survey of Canada, is shown in Figure 18.3 and Table 18.7. Newly released MNDM Mines and Minerals Division publications relating to Southeastern District are listed in Table 18.8.

RECOMMENDATIONS FOR EXPLORATION

Traditional exploration targets in the Grenville Supergroup rocks in southeastern Ontario have been vein-hosted gold deposits, and base metals with iron and zinc dominating. In recent years however, emphasis has shifted to industrial minerals, partly in response to changing technologies in manufacturing industries, which are consumers of industrial minerals, and partly due to an increasing awareness of the industrial mineral potential in this area.

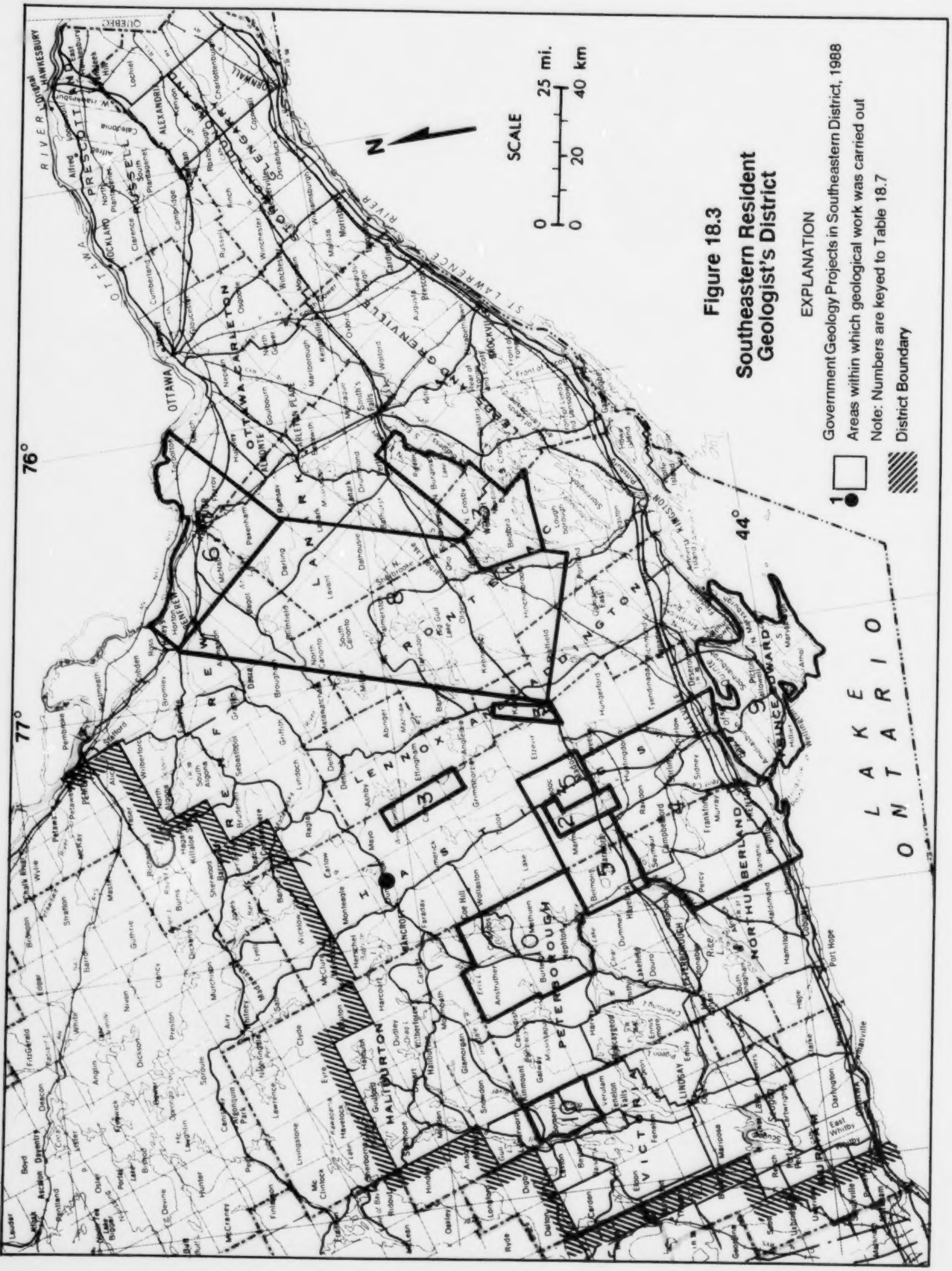
Wollastonite is a calcium silicate mineral with considerable potential for use as a functional filler and as a component in ceramics. Prospecting should be concentrated in marbles located within the thermal aureoles (skarn zones) surrounding granitic plutons in the Marmora–Madoc area and in the area south of Burnstown, where this mineral has been identified in substantial quantities. Similar environments elsewhere in the area deserve attention as well.

The skarn zone hosting the wollastonite deposits around the Deloro pluton in Madoc and Marmora townships also hosts a number of gold deposits, some of considerable interest. Skarn-hosted gold deposits have not, until now, been recognized as important exploration targets in this area, but recent work suggests large tonnage, low-grade gold-bearing zones may be present. There seems to be a close spacial relationship between the wollastonite and the gold mineralization throughout the Deloro skarn. Structural deformation of the host rocks also appears to play an important role in localizing both the gold and wollastonite mineralization.

There are good opportunities for locating large deposits of talc which are essentially free of tremolite and other fibrous silicate minerals, and which grade 30 to 50 percent talc. These are hosted by the volcanic rocks of the Tudor Formation adjacent to the Elzevir and Weslemkoom granites in Elzevir, Madoc, Grimsthorpe, and Cashel townships. Beneficiation test work carried out under this project has shown that high quality talc products of good colour and brightness can be produced from talc deposits in this zone.

Significant and largely unexplored zones of pelitic schists of the Flinton Group outcrop in the Clare River Syncline (Hungerford, Sheffield, and Kaladar townships), and in the long synformal structure along the Fernleigh–Clyde Fault, running through Barrie, Clarendon, Palmerston, South Canonto, and Lavant townships. These schists vary in texture and mineral composition along strike. Industrial minerals contained by the schists include sillimanite, muscovite, garnet, kyanite, staurolite, feldspar, and magnetite. Preliminary mapping and prospecting of these zones suggests that an economic deposit might exist where the grain size of the constituent minerals is sufficiently coarse to allow the production of several mineral products and coproducts. Emphasis should be placed on zones in which sillimanite, muscovite, and staurolite dominate, as these minerals have ready and emerging markets. Sillimanite and staurolite are not presently produced in Canada.

The Griffith Township area, northeast of Denbigh, hosts large marble bands which may have good potential for high purity dolomitic marble for fillers. These same rocks, in places, could provide a source of marble dimension stone. Pink and red granites and grey diorites in the township of the Rear of Leeds and Landsdowne appear to be the best undeveloped sources of granite dimension stone in southeastern Ontario.



N
SCALE
0 20 25 mi.
0 40 km
76°
77°
44°
OTTAWA
QUEBEC
HAWKESBURY
OTTAWA RIVER
ST. LAWRENCE RIVER
PRESCOTT
RUSSELL
GLENGARRY
STORMONT
DUNDAS
GRENVILLE
LEEDS
CARLETON
LANARK
RENFREW
FRONTENAC
LENNOX
ADDINGTON
HASTINGS
PRINCE EDWARD
NORTHUMBERLAND
PETERBOROUGH
VICTORIA
HALIBURTON
DURHAM
LINDSAY
PEMBROKE
KINGSTON
CORNWALL
BROCKVILLE
LAKE ONTARIO
1
2
3
4
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12

Figure 18.3
Southeastern Resident Geologist's District

EXPLANATION

1 ● Government Geology Projects in Southeastern District, 1988

☐ Areas within which geological work was carried out

Note: Numbers are keyed to Table 18.7

▨ District Boundary

TABLE 18.7. GOVERNMENT GEOLOGY PROJECTS, 1988.

MAP NO	PROJECT LEADER	PROJECT	AREA OF WORK	TYPE OF WORK
** ORGANIZATION: Ministry of Northern Development and Mines, Southern Ontario Region				
* DIVISION: Southeastern District, Tweed				
	L.G.D. Thompson	Regional Geophysicist Program	Hastings and Northumberland Counties	Geophysical support of various geology projects.
	D.A. Williams	Unconformity Study (COMDA)	Madoc Area	Mapping of structural geology of Paleozoic rocks, and their relation to fluorite mineralization
1	W.T. Grant	Geological Mapping of Egan Chutes Provincial Park		Geological mapping.
	D.A. Williams, R.R. Wolff, P. LeBaron, P.W. Kingston	Evaluation of Building Stone/ Structural Material/ Ornamental Stone Potential in Southeastern Ontario (COMDA)	All of Southeastern Ontario	Report on granite and marble submitted for publication. Field and office work focussed on the Paleozoic rocks during 1988.
2	A. MacKinnon, P.W. Kingston	Refractory Minerals in Southeastern Ontario (COMDA)	Marmora Area and other localities	Work focussed on detailed mapping of wollastonite occurrences.
3	A. MacKinnon, S.J. Black, P. LeBarron, P.W. Kingston, W.F. Caley	Industrial Minerals of Southeastern Ontario (COMDA)	Various localities in Southeastern Ontario	Detailed mapping of graphite deposits, mapping of a large area with potential for talc, research on using Eastern Ontario industrial minerals in the steel industry.
* DIVISION: Southeastern District, Managed by Ministry of Natural Resources, Kemptville				
4	G.A. Gorrell	Buried Sand and Gravel Features in portions of the Counties of Northumberland and Hastings (COMDA)	Southern Hastings, Northumberland Counties	Detailed study of Quaternary geology. Geophysical support provided by the Tweed Staff Geophysicist
* DIVISION: Specialist's Office, Bancroft				
	B. Goad	Study of Pegmatites in Southeastern Ontario (COMDA)	Various localities in Southeastern Ontario, with concentration on the Bancroft area.	Detailed mapping of pegmatites, and lithogeochemistry
5	H.D. Meyn	Stratigraphy and Sedimentation of Carbonate and Associated Metasedimentary Rocks of the Grenville Supergroup in Southeastern Ontario	Belmont, Marmora, Madoc Townships	Detailed mapping of metasedimentary rocks. In 1988 work was concentrated in Belmont Lake area, Belmont Township.
** ORGANIZATION: Ontario Geological Survey				
* DIVISION: Precambrian Geology				
6	J.S. Springer	Studies of Industrial Minerals in Eastern Ontario	Renfrew-Arnprior area	Looking at faults and the Precambrian/ Paleozoic unconformity for potential deposits of mineral pigments.
7	G.D. DiPrisco	Unconformity study (COMDA)	Stony Lake and Arnprior areas of Eastern Ontario	Investigation of metallogenic factors related to the Precambrian/ Paleozoic unconformity.
8	R.M. Easton	Stratigraphy and mineralization environments of the Central Metasedimentary Belt in the Grenville Province	Sharbot Lake-Arnprior area	Work in 1988 focussed on the Frontenac Terrain Boundary, and the Robertson Lake Shear Zone

TABLE 18.7. CONTINUED.

MAP NO	PROJECT LEADER	PROJECT	AREA OF WORK	TYPE OF WORK
* DIVISION: Engineering and Terrain Geology				
9	G.B. McFall	Structural Geology of Southeastern Ontario	Prince Edward County	Work focussed on neotectonic features: part of Multiagency Group for Neotectonics in Eastern Canada (MAGNEC)
10	J. Dawson	Aggregate Resources Inventories	Anstruther, Burleigh, Chandos, Methuen and Somerville Townships	Preparation of Aggregate Resource Inventory Papers
** ORGANIZATION: Geological Survey of Canada				
* DIVISION: Mineral Resources				
	S.J. Black	Sillimanite Project (COMDA)	Eastern Ontario	In 1988, a large sample was taken from the Clarendon Township sillimanite deposit, and sent out for bench testing.

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1988: Geology and Beneficiation of Talc in the Tudor Formation, Southeastern Ontario; p.351-358 *in* Summary of Field Work and Other Activities 1988, by the Ontario Geological Survey, edited by A.C. Colvine, M.E. Cherry, Burkhard O. Dressler, P.C. Thurston, C.L. Baker, R.B. Barlow, and Chris Riddle, Ontario Geological Survey, Miscellaneous Paper 141, 498p.

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TABLE 18.8. MINES AND MINERALS DIVISION PUBLICATIONS RELATING TO SOUTHEASTERN DISTRICT RELEASED IN 1988.

PUBL	NUMBER	CITATION
** PUBLICATION TYPE: DATABASE		
		Geoscience Database for Microcomputers: Mineral Deposit Inventory (MDI).
** PUBLICATION TYPE: MAP		
P	3124	Quaternary Geology of the Pembroke Area, Renfrew County (31 F/14). Geology by P.J. Barnett and J.G. Leyland, 1979, 1980, 1985. Scale 1:50 000.
** PUBLICATION TYPE: PAMPHLET		
		Building Stone Quarries in Ontario (May 1988).
		Rocks and Minerals Information, 1988, 26p. Compiled by the Geoscience Information Office, Ontario Geological Survey.
** PUBLICATION TYPE: REPORT		
		1987 Ontario Mineral Score (Screen Co-ordinated Resource Evaluation System).
GB	3	Geology and Scenery, Peterborough, Bancroft and Madoc Area: Geological Survey Guidebook No. 3, by D.F. Hewitt, 114 p. Original printing 1969, re-printed 1988.
GDIF	405	Geological Data Inventory of Brudenell Township, Renfrew County (31 F/6). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 37 p. and 1 map.
GDIF	406	Geological Data Inventory of Sebastopol Township, Renfrew County (31 F/6). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 41 p. and 1 map.
GDIF	407	Geological Data Inventory of Griffith Township, Renfrew County (31 F/3,6). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 30 p. and 2 maps.
GDIF	408	Geological Data Inventory of Ross Township, Renfrew County (31 F/10). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 51 p. and 1 map.
GDIF	410	Geological Data Inventory of Herschel Township, Hastings County (31 E/1, F/4). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 37 p. and 1 map.
GDIF	411	Geological Data Inventory of Mayo Township, Hastings County (31 F/3,4, C/13). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 39 p. and 2 maps.
GDIF	412	Geological Data Inventory of Lutterworth Township, Haliburton County (31 D/15). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 33 p. and 2 maps.
GDIF	413	Geological Data Inventory of Harvey Township, Peterborough County (31 D/7,8,9,10). Compiled by the Staff of the Regional Mineral Specialist's Office, Bancroft, 37 p. and 4 maps.
IMBP	8	Fine China, Trials with Ontario Minerals, by Dennis N.S. Salt and edited by J. Stevenson-Demeester, 29 p.
IMBP	7	The Foundry Industry in Ontario and Outlook for Industrial Minerals, by Gallagher + Associates in association with Robert Shnay Associates and Stevenson Kellogg Ernst & Whinney, 44 p., 5 figures, 28 tables.
IMBP	9	Advanced Ceramics: Impact on Ontario Industry, by Hains Technology Associates and MKM Consultants International, 99 p., 39 figures, 26 tables.
MDC	17	Ontario Occurrences of Float, Placer Gold, and Other Heavy Minerals, by S.A. Ferguson and E.B. Freeman, 214 p. Original printing 1978, re-printed 1988.
MDC	18	Gold Deposits of Ontario, Part 2, Part of District of Cochrane, Districts of Muskoka, Nipissing, Parry Sound, Sudbury, Timiskaming, and Counties of Southern Ontario, by J.B. Gordon et al, 253p. Original Printing 1978.
MP	138	Report of Activities 1987, Resident Geologists, edited by C.R. Kustra, 367p.
OFR	5633	Peat and Peatland Resources of Southeastern Ontario, by J.L. Riley, 283 p., 8 figures, 11 tables, 12 photos, 6 appendices, and 6 maps and charts in back pocket.
OFR	5652	Precambrian Geology of the Burleigh Falls Area, Peterborough County, Southern Ontario, by E.G. Bright, 131 p., 7 figures, 16 photos, 5 tables, and map P.3096 in back pocket.
OFR	5688	Ontario Geoscience Research Grant Program, Grant No. 192, Geochemical Exploration for Gold, by I. Nichol and G.S. Shelp, 176 p., and 1 appendix.
OFR	5693	Geology of the Darling Area, Lanark and Renfrew Counties, by R.M. Easton, 206 p., 20 figures, 8 tables, 23 photos, 2 appendices, and Map P.3113 in back pocket.
RPT	241	Geology of the Ardoch Area, Frontenac County, by Liba Pauk, 57p. Accompanied by Map 2514, scale 1:31 680

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19. Southwestern Resident Geologist's District—1988

B.H. Feenstra

Resident Geologist, Ministry of Northern Development and Mines, London.

INTRODUCTION

In 1988, the mineral resources of the Southwestern Resident Geologist's District continued to provide the bulk of Ontario's structural material and nonmetallic mineral wealth at production rates similar or higher than last year; namely, all of the province's salt and gypsum production, nearly all of the clay and shale production, and most of the crushed stone, sand and gravel, calcined lime, cement, and building stone from "limestone" production.

MINING ACTIVITIES

The locations of all operating underground mines and selected operating quarries in the Southwestern Resident Geologist's District are shown in Figure 19.1.

SALT

Rock salt is extracted from the Salina Formation by underground mining methods at Goderich and Windsor. At the Goderich Mine, Domtar Incorporated uses a modified room–and–pillar design in the 23 m thick A–2 Unit bed at a depth of 537 m. At the Ojibway Mine in Windsor, The Canadian Salt Company Limited employs a conventional room–and–pillar method in the 7.5 m thick Middle F Unit bed at a depth of 297 m. Rock salt is primarily used in de-icing (80 to 85 percent), in the manufacture of chloralkali (12 to 20 percent), and in minor miscellaneous markets.

GYPSUM

Gypsum is extracted from the Salina Formation by underground room–and–pillar methods at Caledonia, Hagersville, and Drumbo. Gypsum production is used chiefly for the manufacture of wallboard, which markets were quite active in Ontario during 1988 with a continuation, from 1987, of a high level of building starts.

Domtar Incorporated mines a 2.5 m thick gypsum bed at a depth of 25 m at the No.2 Mine at Caledonia. The company announced plans in 1987 to develop a new mine at Caledonia, starting production in 1990 or 1991. This new No.3 Mine is currently under development as reserves at the No.2 Mine will be depleted within three to four years.

The Canadian Gypsum Company mines an approximately 1 m thick gypsum bed at a depth of 30 m north of Hagersville; tonnage production is up from last year.

Westroc Industries Limited mines a 1.7 m thick gypsum bed at the much greater depth of 116 m near Drumbo; tonnage production is the same as last year.

BUILDING STONE

Adair Marble Quarries Division of Arncraft Corporation quarries 10 t dimension stone blocks from blue–grey–mottled, thick–bedded Amabel Formation dolostone near Hope Bay, in the Bruce Peninsula. The quarry operation experienced an excellent year in both stone quality and tonnage production (up 20 percent from last year). Quarrying methods consist mainly of drilling and broaching, although the company is experimenting with a wire saw acquired early in 1988. The company continued the testing of quarry blocks for the development of an adjacent, second Adair Marble Quarries Division quarry.

Owen Sound Ledgerock Limited quarries thin– to medium–bedded Eramosa dolostone at one operation near Owen Sound, and at another near Wiarton, for the production of flagstone, drywall stone, patio stone, hearths, mantels, sills, and marble. The company reports an increase in tonnage production over last year, particularly in stone for higher value products. Much stripping was carried out at the Owen Sound quarry operation, while the Wiarton quarry was deepened by 1.5 m for the extraction of "marble" beds. In 1988, the company acquired a trim saw, curve saw, and strip polisher for its new marble–finishing plant constructed last year at the Owen Sound quarry site.

SHALE

In Ontario, Canada Brick Limited actively operates six quarries in shales of the Queenston and Georgian Bay formations, five of which are in the Southwestern Resident Geologist's District. The company has not yet produced from another Queenston Shale quarry in the area (i.e., the Niagara Pit near St. Davids) since acquiring it in 1981. Total production in 1988 for Canada Brick Limited is similar to last year's high level. Remaining shale reserves at each of the operations will last at least another 10 years at current rates of production. The company has brought the new Burlington No.2 plant (three tunnel kilns) to nearly full production since its start–up last year.

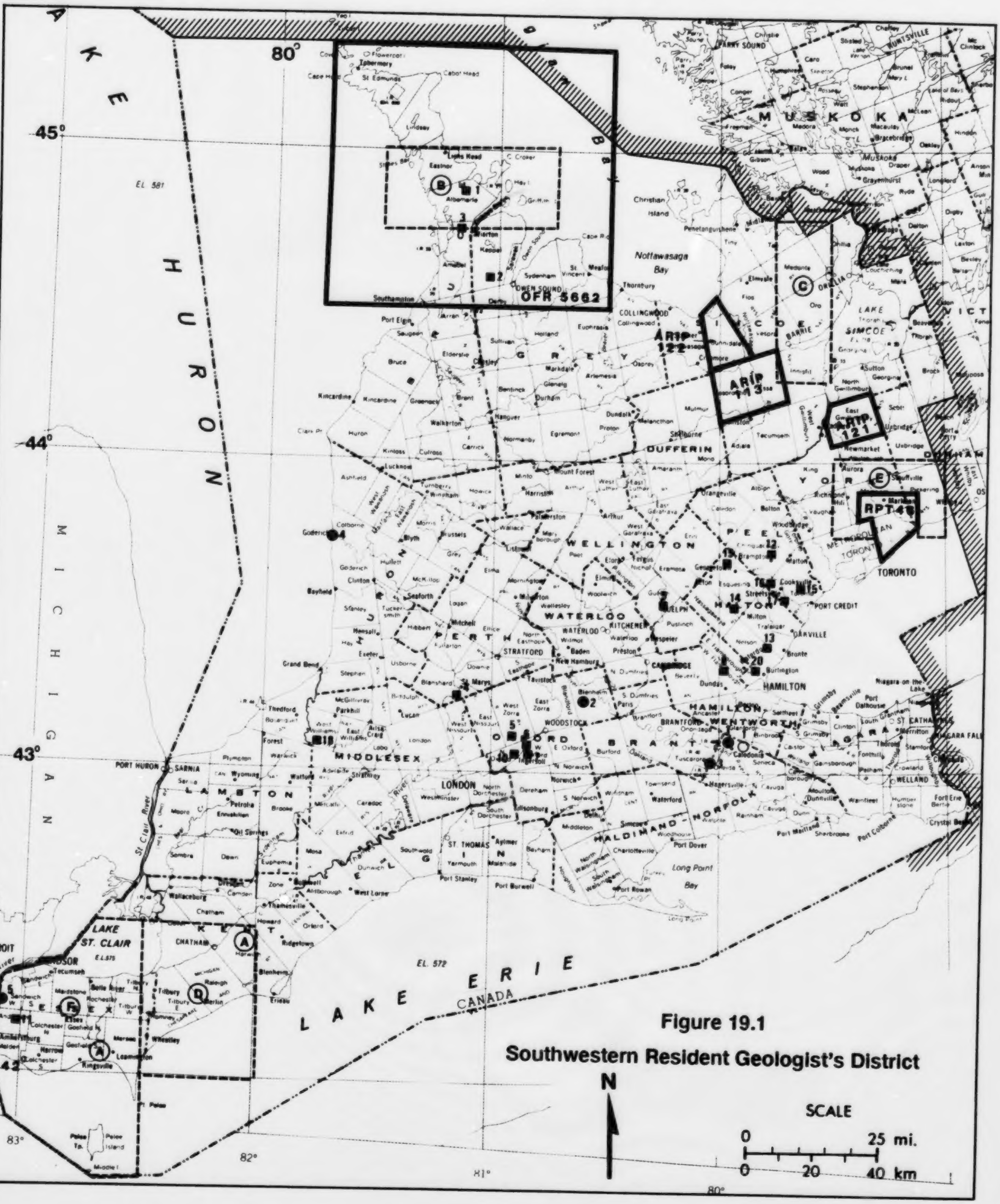

LAKE HURON
MICHIGAN
LAKE ERIE
GEORGIAN BAY
MUSKOKA
SIMCOE
GREY
DUFFERIN
WELLINGTON
PEEL
YORK
WATERLOO
PERTH
HURON
MIDDLESEX
OXFORD
BRANT
HAMILTON-WENTWORTH
HALDIMAND-NORFOLK
NIAGARA
LAMBTON
KENT
ESSEX
ELGIN
LAKE ST. CLAIR
LAKE SIMCOE
TORONTO
HAMILTON
LONDON
OFR 5662
ARIP 122
ARIP 113
ARIP 121
RPT 49
CANADA
EL. 581
EL. 572
80°
45°
44°
43°
42°
83°
82°
81°
80°

Figure 19.1

Southwestern Resident Geologist's District

EXPLANATION

▨ District Boundary

Location of Ontario Geological Survey Field Projects, 1988

○ A. Buried Aggregate Assessment, Leamington and Pinehurst

⬚ B. Paleozoic Mapping, Bruce Peninsula
C. Quaternary Geology, Barrie – Elmvale Areas
D. Quaternary Geology, Chatham – Romney Areas
E. Quaternary Geology, Markham Area
F. Quaternary Geology, Windsor – Essex Areas

▭ Maps/Reports issued by Ontario Geological Survey, 1988

● Producing Mines, 1988

Gypsum
1. Caledonia No. 2. – Domtar Inc.
2. Drumbo – Westroc Industries Limited
3. Hagersville – Canadian Gypsum Company

Salt
4. Goderich – Domtar Inc.
5. Ojibway – The Canadian Salt Company Limited

○ Mines under Development, 1988

Gypsum
1. Caledonia No. 3 – Domtar Inc.

■ Selected Producing Quarries, 1988

Limestone (L)/Dolostone (D)

Building Stone
1. Adair No. 1 (D) – Adair Marble Quarries Division Arriscraft Corp.
2. Owen Sound (D) – Owen Sound Ledgerock Limited
3. Wiarton (D) – Owen Sound Ledgerock Limited

Cement
4. St. Marys (L) – St. Marys Cement Company
5. Woodstock (L) – Lafarge Corporation

Lime
6. Beachville E. (L) – BeachviLime Ltd. (Dofasco)
7. Beachville W. (L) – BeachviLime Ltd. (Dofasco)
8. Dundas (D) – Steetley Lime and Aggregates
9. Guelph (D) – Guelph Dolime Limited (BeachviLime Ltd.)
10. Ingersoll (L) – Stelco Inc.
11. McGregor (L) – General Chemical of Canada Ltd.

Shale

Brick
12. Brampton – Brampton Brick Limited
13. Burlington (Tansley) – Canada Brick Limited
14. Milton – Canada Brick Limited
15. Mississauga (Cooksville) – Canada Brick Limited
16. Mississauga (Streetsville C.) – Canada Brick Limited
17. Mississauga (Streetsville S.) – Canada Brick Limited

Brick and Drain Tile
18. Arkona – Martin Clay Products
19. Georgetown – Amos C. Martin Limited

Brick, Filter Tile, Flower Pots, Flue Liner and Sewer Pipe
20. Burlington (Waterdown) – National Sewer Pipe Limited

Brampton Brick Limited extracted more Queenston Shale in 1988 from its "pit" at Brampton which currently feeds three plants; namely, the old plant at Brampton, the new Brampton plant started this year, and the Bayview Avenue, Toronto, plant (Don Valley Brickyard). The company plans to start production in 1989 from its Cheltenham operation in the Queenston Shale, as only five years of reserves are remaining at the Brampton site.

RESIDENT GEOLOGIST'S ACTIVITIES

The office is located in the main provincial government building at 659 Exeter Road (Highway 135), London. Staff includes Bern Feenstra, Resident Geologist, and Susan Brown, Secretary. Seasonal geological staff included Jo-Anne Potter (Section 38 Gypsum Project), and Rob Bucci (Experience '88 Summer Assistant).

The Resident Geologist provided an increasing number of private companies, individuals, and government agencies with geoscience and industrial mineral resource information in support of exploration, development, and land-use planning in the, Southwestern Resident Geologist's District.

Information provided for the stimulation of potentially new exploration and development include the following mineral resource topics:

1. The Sylvania Sandstone as a source of silica
2. New high-purity limestone sources in the Formosa Reef Limestone and in the Lucas Formation
3. New sources of shale in the Queenston and Arkona formations for use as raw materials for heavy clay products
4. New sources of building stone in the Eramosa Dolomite and Gull River Limestone
5. New sources of crushed stone in the Dundee, Lucas, and Guelph formations, for construction aggregate products

In a small experimental project, shear wave reflection seismic techniques were successfully applied in the detection of sequences of clay and buried, groundwater-saturated, sand and gravel in the Pinehurst area near Chatham. Testing and interpretation of the results was completed by A-Cubed Inc. of Mississauga.

The Resident Geologist attended a short course in "Modern Methods of Geophysical Surveying in Glaciated Terrains" at the University of Waterloo.

Work is currently in progress to complete the preliminary maps of the Quaternary geology of the Markdale-Owen Sound areas for publication scheduled in 1989.

Jo-Anne Potter completed her study on the geology, former mining activities, and potential hazards at the 17 abandoned gypsum mines in the Paris-Caledonia-Cayuga area.

The Resident Geologist investigated a reported cave-in at Domtar's abandoned gypsum mine at Caledonia. The mine has virtually no roof at this site, and more than 2000 t of clay overburden (12 m thick) collapsed into the abandoned mine. The company completed the necessary remedial work immediately.

The office maintains a publicly accessible geoscience and mineral resource information reference library, and is responsible for selling reports and maps published by the Mines and Minerals Division, prospector's licences, and claim tags. Copies of the Mining Act as well as staking and working claim forms may also be obtained at the office.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The location of project areas in the Southwestern Resident Geologist's District, for which the Ontario Geological Survey published maps and reports during 1988, are outlined in Figure 19.1; the published maps and reports are listed in the section—Selected Publications Received.

The location of 1988 field investigations by the Ontario Geological Survey in the Southwestern District are also shown in Figure 19.1. The following is a brief listing of these projects:

1. Buried aggregate assessment, Leamington and Pinehurst areas
2. Paleozoic mapping, Bruce Peninsula (Wiarton-Lions Head area)
3. Quaternary geology, Barrie-Elmvale area (eastern part)
4. Quaternary geology, Chatham-Romney area (south of Highway 401)
5. Quaternary geology, Markham area
6. Quaternary geology, Windsor-Essex area (eastern part)

RESEARCH BY OTHER AGENCIES

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

The following academic studies pertaining to Southwestern Ontario received Ontario Geoscience Research Grants for the period 1988-1989:

1. S.J. Haynes, Department of Geological Sciences, Brock University, received Grant 319 for the study "Gypsum Deposits of Southern Ontario".
2. L. Smith, Department of Geological Sciences, Queen's University, received Grant 295 for the study "Karst Episodes and Permeability Development, Silurian Reef Reservoirs, Ontario".

3. R.C. Bailey, Geology and Physics departments, University of Toronto, received Grant 290 for the study "Maximal Simplicity Gravity Interpretation with Continuous Density Models".
4. P.F. Karrow, J.P. Greenhouse, Department of Earth Sciences and Quaternary Sciences Institute, University of Waterloo, and M.B. Dusseault, Department of Earth Sciences and Civil Engineering, University of Waterloo, received Grant 312 for the study "Subsurface Quaternary Stratigraphy Using Borehole Geophysics".
5. M. Coniglio, Department of Earth Sciences and Quaternary Sciences, University of Waterloo, received Grant 351 for the study "Stratigraphy and Sedimentology of the Upper Ordovician Georgian Bay Formation".
6. M.J. Risk, Department of Geological Sciences, McMaster University, received Grant 340 for the study "Stratigraphy, Facies, and Paleoecology of the Devonian Dundee Formation".
7. H.W. Nesbitt, Department of Geological Sciences, University of Western Ontario, received Grant 336 for the study "Metal Residence Sites in Tills".

SELECTED PUBLICATIONS RECEIVED

The following maps and reports pertaining to the Southwestern Resident Geologist's District were published during 1988 by the Ontario Geological Survey.

Armstrong, D.K., and Meadows, J.R.

1988: Stratigraphy and Resource Potential of the Eramosa Member (Amabel Formation), Bruce Peninsula, Ontario; Ontario Geological Survey, Open File Report 5662, 90p., 3 figures, 3 tables, 16 plates, and 1 map in back pocket.

Karrow, P.F.

1967: Pleistocene Geology of the Scarborough Area, Ontario Department of Mines, Geological Report 46, 108p. Accompanied by Maps 2076, 2077, scale 1:31 680 or 1 inch to 1/2 mile, and 2 charts. Reprinted 1988.

Mineral Development and Lands Branch

1988: Building Stone Quarries in Ontario: Directory, May 1988; A free brochure produced by the Industrial Minerals Section, Ministry of Northern Development and Mines, 14p.

Ontario Geological Survey

1988a: Aggregate Resources Inventory of Essa and Tosorontio Townships, Simcoe County; Ontario Geological Survey, Aggregate Resources Inventory Paper 113, 48p., 10 tables, 9 figures, 3 maps, scale 1:50 000.

1988b: Aggregate Resources Inventory of the Town of East Gwillimbury, Regional Municipality of York; Ontario Geological Survey, Aggregate Resources Inventory Paper 121, 38p., 10 tables, 3 figures, 3 maps, scale 1:50 000.

1988c: Aggregate Resources Inventory of Sunnidale Township, Simcoe Township; Ontario Geological Survey, Aggregate Resources Inventory Paper 122, 49p., 11 tables, 11 figures, 3 maps, scale 1:50 000.

Vanderveer, D.G., and Finley, W.D.

1988: Electromagnetic Conductivity as a Tool to Delineate Buried Sand and Gravel Deposits in the Pinehurst and Leamington Areas of Southwestern Ontario; scale 1:10 000. (Available for viewing only at the Mines Library, Ontario Geological Survey, Toronto, and the Resident Geologist's Office, London).

20. Petroleum Resources Section, Ministry of Natural Resources—1988

T.R. Carter

Senior Petroleum Geologist, Petroleum Resources Section, Ministry of Natural Resources, London.

INTRODUCTION

There was a major increase in the exploration for, and the development of, oil and natural gas reservoirs in southwestern Ontario in 1988. A total of 210 drilling permits had been issued by the end of November, compared to 109 for all of 1987.

Drilling results had been reported for a total of 113 wells at the time of writing. These consisted of 40 exploratory wells, 61 development wells, and 12 service wells. The exploratory drilling resulted in 11 wells completed as oil producers and 7 as gas producers, for a success rate of 45 percent (*see* Table 20.1, Figure 20.1). The development drilling resulted in 24 wells completed as oil producers and 20 as gas producers, for a success rate of 72 percent.

The exploration and development of Ordovician reservoirs continued to be the highlight of drilling activity in Ontario. Drilling of Ordovician targets increased significantly, with drilling reported to be complete at 15 exploratory and 12 development wells, compared to 20 wells in all of 1987. The exploratory drilling is reported to have resulted in 8 oil producers and 2 gas producers, while the development drilling resulted in 8 oil producers and 1 gas producer.

Oil production in Ontario increased dramatically in 1988. The projection of current figures indicates that total oil production will exceed 190 000 m^3 in 1988, compared to 135 635 m^3 in 1987, and only 84 610 m^3 in 1983. The increase is due entirely to production from new Ordovician reservoirs discovered since 1983. Some of the wells in these new pools are capable of initial sustained production in excess of 47 m^3 of oil per day or 300 barrels of oil per day (BOPD).

OIL AND GAS PRODUCTION AND RESERVES

Oil production, up to and including the end of October 1988, consisted of 157 202.6 m^3 of oil. The projected production to the end of the year is estimated to be in excess of 190 000 m^3. This compares with a production of 135 635 m^3 of oil in 1987, a 40 percent increase, and an increase of over 126 percent since 1983, when only 84 610 m^3 were produced.

Essex County continued to produce the largest proportion of Ontario's oil in 1987, largely due to the Hillman pool. In 1987, this one Ordovician pool produced 40 892.8 m^3 of oil, which is approximately 30 percent of the total production of the province.

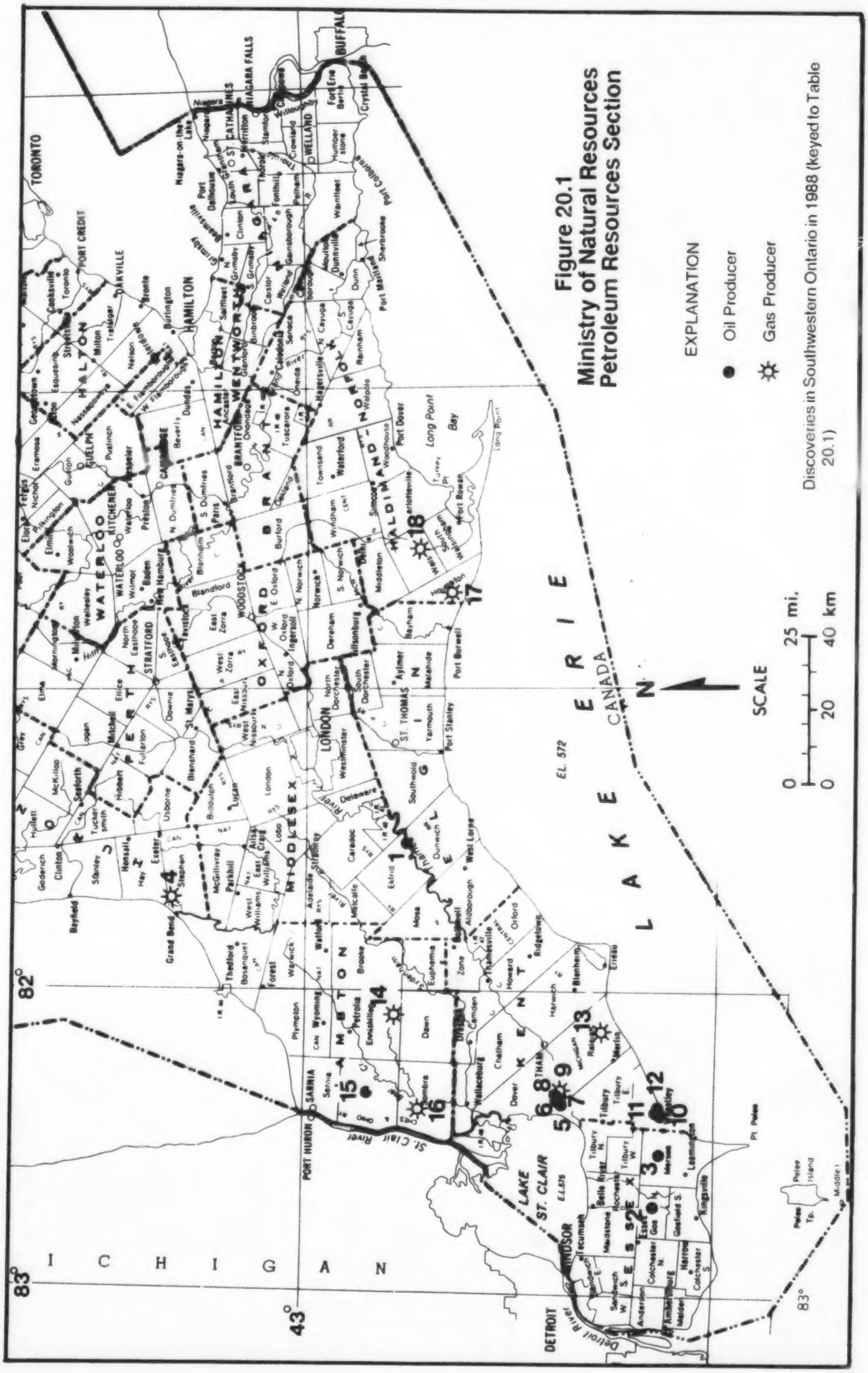
Production of natural gas, up to and including the end of October 1988, consisted of 424.8 million m^3. This consists of 320 million m^3 from wells on Lake Erie, and 104.8 million m^3 from wells on land. The projected production to the end of the year is estimated to be 495 million m^3. This is a 3 percent decrease from 1987, and represents a normal rate of production decline, as new discoveries failed to keep pace with production.

The compilation of statistics on cumulative production, and potential and proven reserves has recently been completed. These are presented in Table 20.2 and are derived from the results of work completed by Ontario consultants Robert Cochrane, and Bailey Geological Services, under the Hydrocarbon Energy Resources Program. The remaining proven recoverable reserves as of the end of 1981 were 887 000 m^3 of oil and 15.44 billion m^3 of natural gas. No calculation of current (1988) remaining recoverable reserves has been made, as no estimates of reserves in newly discovered pools is available.

Prices received by producers for natural gas production continued to decline throughout 1988. The weighted average price paid to Ontario producers in October 1988 was $73.91 per 1000 m^3, compared to $113.67 in January 1988. Oil prices fluctuated, but generally declined. The Esso Resources Canada Limited price for Mersea Township crude oil declined from $152.69 on November 20, 1987, to $136.60 per m^3 on January 8, and to $107.24 on November 29, 1988.

EXPLORATION AND DEVELOPMENT ACTIVITY

As indicated above, there was a major increase in the exploration for, and the development of, oil and natural gas in Ontario in 1988. Projected figures indicate that a total of nearly 200 wells will have been drilled in Ontario by the end of the year, compared to only 104 wells drilled in all of 1987. This increase is due to a number of factors: a resumption of drilling on Lake Erie by Pembina Resources Limited and


TORONTO
PORT CREDIT
OAKVILLE
HAMILTON
ST. CATHARINES
NIAGARA FALLS
BUFFALO
WELLAND
GUELPH
KITCHENER
WATERLOO
STRATFORD
WOODSTOCK
BRANTFORD
LONDON
ST. THOMAS
SARNIA
PORT HURON
WINDSOR
DETROIT
MICHIGAN
LAKE ST. CLAIR
LAKE ERIE
CANADA
Long Point Bay
St. Clair River
Detroit River
43°
82°
83°
N
SCALE
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25 mi.
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40 km
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Figure 20.1
Ministry of Natural Resources
Petroleum Resources Section

EXPLANATION

● Oil Producer

☼ Gas Producer

Discoveries in Southwestern Ontario in 1988 (keyed to Table 20.1)

TABLE 20.1. DISCOVERIES IN SOUTHWESTERN ONTARIO IN 1988.

Map No.	Latitude Longitude	Well Name	Target	Metres Drilled	Class Status	Compl. Date
ELGIN						
1	42 45'32" 81 31'30"	Judo Dunwich 8-22-BF-A	Cambrian	1084.0	NPW OP	88.04.28
ESSEX						
2	42 08'37" 82 43'38"	O.K. West No.2-W. Newman No.2 Gosfield North 13-IX	Cambrian	0.0	DPT OP	88.08.26
3	42 07'21" 82 31'23.5"	Ram/B.P. 2 Mersea 8-16-VIII	Ordovician	1077.0	NPW OP	88.02.24
HURON						
4	43 19'53.5" 81 40'35"	Pamax et al Stephen 2-23-XVI	Salina-Guelph	576.1	NPW GP	88.04.23
KENT						
5	42 21'51" 82 21'30"	PPC/Ram 13 Dover 3-3-IV E	Ordovician	1106.0	NPW OP	88.05.21
6	42 22'16" 82 20'30.5"	PPC et al 15 Dover 5-5-IV E	Ordovician	1067.0	NPW OP	88.02.23
7	42 22'04.5" 82 20'38"	PPC 16 Dover 7-5-IV E	Ordovician	1070.0	NPW OP	88.01.19
8	42 22'21" 82 20'12"	PPC 12 Dover 6-6-IV E	Ordovician	1081.4	NPW OP	88.03.10
9	42 22'10" 82 19'27"	PPC/Ram 20 Dover 3-7-III E	Ordovician	1157.0	NPW GP	88.06.10
10	42 08'05" 82 26'24"	Consumers' et al 34346 Romney 1-12-III	Ordovician	1101.0	NPW OP	88.06.12
11	42 08'12" 82 26'26"	Consumers' et al 34347 Romney 6-13-IV	Ordovician	851.0	NPW OP	88.05.30
12	42 07'44" 82 24'54"	Consumers' et al 34344 Romney 3-14-II	Ordovician	1071.0	NPW OP	88.05.11
13	42 16'16.5" 82 06'01"	Ram/BP 4 Raleigh 2-14-XIV	Ordovician	1208.0	NPW GP	88.08.04
LAMBTON						
14	42 46'48" 82 05'17"	Perma Enniskillen 2-21-II	Salina-Guelph	603.2	NPW GP	88.03.16
15	42 50'50" 82 20'24"	Capricorn Moore 2-14-VII	Salina-Guelph	719.3	NPW OP	88.02.23
16	42 43'22.5" 82 23'00"	Hadley-Midway Sombra 5-11-XII	Salina-Guelph	672.4	NPW GP	88.06.21
NORFOLK						
17	42 38'36" 80 40'27"	Hemlock 12 Houghton 8-4-II	Clinton-Cataract	449.6	NPW GP	88.08.23
18	42 43'36.5" 80 31'45"	Bayview 16 North Walsingham 3-17-IX	Clinton-Cataract	378.3	NPW GP	88.05.12

The Consumers Gas Company Limited; an increase in exploration for Silurian reefs; a major development drilling program in the Rodney oil pool; and a significant increase in the number of wells drilled to test Ordovician targets. These increases have occurred despite the collapse of oil and gas prices and the major decline in drilling activity in most other jurisdictions. Judging from the number of inquiries received from outside the province in 1988, this may indicate an influx of outside investment into Ontario due to the generally lower costs of exploration in Ontario, the higher producer prices received for production due to proximity to markets, and the growing interest in the very successful Ordovician oil play. The increase in Ordovician drilling is also probably attributable to aggressive competition among the companies involved, and the necessity to drill wells in order to maintain oil and gas leases in good standing.

Drilling results had been reported for a total of 113 wells by the end of November. These consisted of 61 development, 40 exploratory, and 12 service wells. The exploratory wells resulted in 11 oil producers and 7 gas producers, while the development drilling resulted in 24 oil producers and 20 gas producers. The service wells consisted of 3 stratigraphic tests, 4 brine disposal wells, 3 observation wells, 1 natural gas storage well, and 1 solution mining well.

A total of 31 wells were drilled on Lake Erie, consisting of 3 exploratory wells and 28 development wells. Five of the development wells were targeted on Silurian reefs and resulted in four gas producers. The remaining wells were all targeted on Silurian sandstones. Twelve of the development wells were completed as gas producers. None of the exploratory wells were successful.

Onshore drilling consisted of 33 development wells, 37 exploratory wells, and 12 service wells. Fifteen of the exploratory wells were targeted on Ordovician strata and resulted in 8 oil producers and 2 gas producers. These Ordovician reservoirs typically are contained in dolomitized limestone along linear faults or fractures, in Trenton or Black River Group strata. Four exploratory tests of Cambrian sandstones resulted in two oil producers: one in Essex County, in a re–entry of a previously drilled well; and one in Elgin County. Fifteen wells were drilled to test Silurian carbonates in a search for Guelph Formation reefs and associated reservoirs in the overlying Salina Group A–1 and A–2 units. Three of these wells were completed as gas producers and one as an oil producer. Only two exploratory wells were drilled for Silurian sandstone targets in 1988. Both wells were completed as gas producers. One unsuccessful exploratory test of Devonian strata was drilled. The well is being assessed for possible use as an oil–field brine disposal well.

Twelve of the development wells drilled onshore in Ontario in 1988 were targeted on Ordovician strata, and resulted in eight oil producers and one gas producer. Two Cambrian development wells were drilled, with one of these being completed as a gas producer. One of the three Silurian carbonate tests was completed as a gas producer, and the one Silurian sandstone development well drilled onshore in 1988 was also completed as a gas producer. Sixteen Devonian development wells were drilled in 1988. All of these wells were drilled in the Rodney oil pool in Elgin County and all were completed as oil producers.

Ram Petroleums Limited announced that it has entered into an agreement with BP Canada Incorporated, whereby BP will purchase $500 000 of Ontario seismic survey results. BP has also committed to spend $2 million in 1988 on Ram's undeveloped oil and gas leases in Essex County, and a portion of Kent County, in order to earn a 16 2/3 percent interest in approximately 25 500 hectares (63 000 acres) of leases. BP has an option to earn an additional 16 2/3 percent in the leases in 1989 and 1990 by making yearly expenditures of $2.2 million.

The experimental, horizontal oil–drainage project, operated by Devran Petroleum Ltd. of London, Ontario, and Shell Canada Limited in the abandoned Devonian Sarnia–London Road oil pool, was abandoned in 1988. The operators were unable to overcome problems caused by the excessive production of formation water at the project. The company has not yet released a final report on the results of the project.

STAFF ACTIVITIES

Geological program staff employed at the Petroleum Resources Section during the year consisted of Bob Trevail, Chief Geologist; Terry Carter, Senior Petroleum Geologist; Mahendra Narain, Aggregate Resources Geologist; Malcolm Campbell, Petroleum Resources Lab Technician; Debra Parker, Resource Geologist; and Marg Bernardo, Clerk Typist. Other staff employed during the year include Andre Laflamme, Geological Assistant; and Philip Vicker (Experience '88). Bob Trevail resigned as Chief Geologist at the end of October in order to take a position as Area Geologist with The Consumers Gas Company Limited.

Engineering and administrative staff include Pentti Palonen, Mineral Resources Co–ordinator; Rudy Rybansky, Offshore Engineer; Ernie Habib, Onshore Engineer; Karen McLeod, Petroleum Engineering Technologist; Peter Wright, Administrative Assistant; Cathy Hesselmans, Systems Analyst; Frances McKeon, Data Processing Technician; Ian Cameron, Draftsperson; Arlene Hawley, Program Secretary; Brigitte Davidson, Clerk Typist; and Greg Stephenson, Data Processing Technician. Peter Wright retired in the latter half of the year.

Petroleum Resources inspectors, responsible for the enforcement of the Petroleum Resources Act and associated regulations, are located in the Simcoe and Chatham district offices. Mike Hunter, Deputy Chief Inspector; Lee Chambers; and Bob Lewis are located in Simcoe. Bob Sealey and Rod Corea operate out of the Chatham office.

Geological staff continued their efforts to encourage investment in Ontario's oil and gas industry by providing geological information and advice to various private individuals and companies, government agencies, and academic institutions. Numerous inquiries and(or) office visits were made by industry representatives from Michigan and Calgary, with additional inquiries from Ohio, Texas, Pennsylvania, Colorado, Louisiana, and New York. Some of these inquiries resulted in significant new out–of–province investments of both time and money in the Ontario petroleum industry.

Four technical papers were presented by section staff in 1988. T.R. Carter presented a paper at the May 1988 regional meeting of the Canadian Sedimentology Research Group in Kingston entitled "A comparison of the Middle Proterozoic Balmat evaporite sequence with Niagaran and Cayugan strata in the Michigan–Appalachian basins". R.A. Trevail presented a paper entitled "The distribution of Ordovician altered volcanic ash (K–bentonites) in southern Ontario" at the same meeting, and at the Geological Association of Canada (GAC) 1988 Annual Meeting in St. Johns, Newfoundland (Trevail 1988a). Trevail presented a second paper at the GAC meeting (Trevail 1988b), and a third paper (Trevail, in preparation) at the 27th Annual Conference of the Ontario Petroleum Institute, held in London, Ontario.

T.R. Carter continued work on a long–term subsurface mapping project in Lambton County. The project was started in 1987, utilizing staff hired under Section 38 of the Unemployment Insurance Act. Cuttings samples and wireline logs are being utilized to repick formation tops of selected stratigraphic units, principally to provide guidelines in the search for Silurian reefs, and secondly to help locate subsurface faults which may be associated with Ordovician oil and gas reservoirs. New 1:50 000 scale National Topographic System (NTS) base maps have been prepared for the plotting and contouring of results.

R.A. Trevail continued his study of Ordovician oil and gas reservoirs, and the stratigraphy and sedimentology of the Trenton and Black River groups. Work was also continued by Andre Laflamme, under the supervision of Trevail, on a study of the stratigraphy of the Cambrian strata in the subsurface of southwestern Ontario.

R.A. Trevail completed work on the "Oil and gas exploration, drilling, and production summary, 1984", and T.R. Carter completed the 1985 summary. Both summaries are currently being edited, and should be available early in 1989. Work on the 1986 summary should be completed early in 1989. Trevail has also nearly completed work on an updated pools and pipelines map. Geological staff in the Petroleum Resources Section are also responsible for the preparation of a summary of oil and gas developments in eastern Canada each year, for the American Association of Petroleum Geologists, in conjunction with staff of the Canada Oil and Gas Lands Administration (Carter and Campbell 1988).

Fifty–two preliminary maps at a scale of 1:100 000, constituting part of phase five of the Hydrocarbon Energy Resources Program, the Silurian reef complex report, were released on October 13, 1988, by the Ontario Geological Survey (Bailey Geological Services and Cochrane 1988a, 1988b). The maps show the regional structural contours on the top of the Salina A–2 Carbonate Unit, and isopach contours of the top Rochester to top Guelph Formation interval. Pool maps from this report are expected to be ready for release early in 1989.

DRILL SAMPLE STORAGE PROGRAM

Core and drill–cuttings samples from wells penetrating the Phanerozoic strata of southwestern Ontario, the Ottawa Lowlands, and the onshore portion of the James Bay Lowlands, are available for examination at the Petroleum Resources Laboratory. Operators of all wells and boreholes permitted for drilling under the Petroleum Resources Act are required to submit drilling samples to the Ministry of Natural Resources for storage in the Petroleum Resources Laboratory. Samples are delivered directly to the Lab, either by the operator or by the Petroleum Resources inspectors.

In addition to the routine collection, processing, and cataloguing of drill cuttings, several important new additions to the core collection were made in 1988. These include the following: Consumers' *et al.* 34345 Romney 13–III—Cobourg Formation to Verulam Formation; PPC 12 Dover 6–IV East—Coboconk Formation; and Cansalt DDH 87–3 Fighting Island—Lucas Formation to Salina E Unit. Several other important cores were received, but these have not yet been slabbed and catalogued.

RECOMMENDATIONS FOR EXPLORATION

Ordovician oil reservoirs are currently the most attractive targets for exploration in southwestern Ontario, and will probably remain so for the next five years or more. These reservoirs occur in dolomitized limestones along linear faults and fractures in the Trenton or Black River groups. There have also been some significant discoveries of natural gas in this same type of trap. Essex County and the southern part of Kent County have been the focus of recent activity, but much larger areas are believed to be prospective.

TABLE 20.2. HYDROCARBON RESERVES IN SOUTHWESTERN ONTARIO.

GEOLOGICAL STRATA	CUMULATIVE PRODUCTION TO END 1981		PROVEN RECOVERABLE RESERVES-1981		POTENTIAL RESERVES		REMAINING POTENTIAL 1981		PRODUCTION 1982-1986		CUMULATIVE PRODUCTION TO END 1986	
	OIL	GAS	OIL	GAS	OIL	GAS	OIL	GAS	OIL	GAS	OIL	GAS
Devonian	6,374	0	6,808	0	17,670	0	10,862**	0	173	0	6,547	0
Salina/Guelph	1,618	15,783	1,929	25,293	2,884	29,531	955	4,238	176	1,131	1,794	16,914
Clinton/Cataract	7	8,113	7	13,650	7	35,167	0	21,517**	0	1,527	7	9,640
Ordovician	183	396	214	447	5,439	9,703	5,226	9,256	121	13	304	409
Cambrian	682	128	793	470	17,706	6,271	16,913	5,801	39	30	721	158
Total	8,864	24,420	9,751	39,860	43,706	80,672	33,956	40,812	509	2,701	9,373	27,121

* Production and reserves are in thousands of cubic metres (oil) and millions of cubic metres (natural gas)

** Most of these reserves are offshore. Exploration for oil on the Great Lakes is not permitted.

There has been an increase in exploration for Silurian reef reservoirs in 1988, with some degree of success. Most of the activity has taken place in the pinnacle reef belt in Lambton County. However, the recent deregulation of the natural gas industry may make exploration in Huron County—the northern extension of the pinnacle reef belt—more attractive. Direct sales by producers to customers are now permitted; consequently, the dependence on proximity to distribution pipelines operated by major utilities is not as critical. The lack of pipelines is one factor which has held back exploration and development in this area, although there are also concerns over salt-plugging and low reservoir pressures.

To date, there has been very little exploration for Cambrian oil and gas reservoirs. These strata have very significant potential reserves (*see* Table 20.2) and are expected to be a focus of activity once the current interest in Ordovician targets begins to decline.

There are still very significant potential reserves of natural gas remaining to be discovered or developed under the waters of Lake Erie (*see* Table 20.2). Exploration and development activity is expected to continue at current levels for the near future.

RESEARCH BY OTHER AGENCIES

Three MSc theses on topics relevant to the Paleozoic geology of southwestern Ontario were completed in 1988. These are included in the list of references (Dollar 1988; Grimes 1988; O'Shea 1988). Work on three BSc theses is underway at the University of Western Ontario. Steve Donaldson is conducting research on the "Depositional setting of the Upper Ordovician Queenston Formation, southwestern Ontario", under the supervision of Guy Plint. Cameron Tsujita is working on "Trilobite paleo-ecology of the Lower Whitby Formation", and Cheryl Senior is working on "Reclassification of the graptolites in the Whitby Formation". Both these theses are being supervised by Alf Lenz.

Work is also underway on four projects funded by the Ontario Geoscience Research Grant Program:

1. Permeability development and off-reef deposition during karst episodes, Silurian reef reservoirs, Ontario; L. Smith, Queen's University, Kingston
2. Stratigraphy and sedimentology of the Upper Ordovician Georgian Bay Formation; M. Coniglio, University of Waterloo, Waterloo
3. Gypsum deposits of southern Ontario; S. Haynes, Brock University, St. Catharines
4. Stratigraphy, facies, and paleo-ecology of the Devonian Dundee Formation; M.J. Risk, McMaster University, Hamilton

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1988b: Tectonic and Diagenetic Controls on Development of the Hillman Pool, Trenton Group, Southwestern Ontario; Geological Association of Canada-Mineralogical Association of Canada-Canadian Society of Petroleum Geologists, Program with Abstracts 13, p.A126.

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